Annex J

The Master Plan

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J The Master Plan

J.1 Outline of the Master Plan

J.1.1 Goals

The principal goal of the Master Plan is to establish a sound Solid Waste Management System by the target year 2015 in Municipality of Panama, where the population and major economic activities of the country are contered

the country are centered.

The Master Plan aims to:

- promote the citizens' well-being;
- implement sustainable SWM; and
- contribute to environmental conservation.

The goals in practice of the Master Plan are as follows:

- 1. The improvement of public health and the reduction of health hazards in and around the city is a primary task of SWM, in order to promote the citizens' well-being.
- 2. As implementation of sustainable SWM services is the duty and mandate of the DIMAUD, the DIMAUD should expedite:
- cost-effective SWM by continuous technical improvement;
- cost-effective SWM by continuous legal/institutional improvement; and
- cost-effective SWM by continuous administrative improvement of DIMAUD.
- 3. As the environmental conservation through SWM is today's requirement, DIMAUD should expedite the following:
- encouragement of further citizens' environmental awareness on waste minimization,
- promotion of environmental conservation through "reduction", "recycling" and "recovery" of waste, and
- operation of solid waste processing and disposal facilities without polluting the environment.

In other words, well-being of citizens will be indirectly achieved by providing cost-effective SWM services. Meanwhile, a **"beneficiary-pays-principle (under which recipients pay for the services)"** has to take root in the citizens' values. These will improve the cost-consciousness of the citizens and induce **"waste minimization at source"** by each citizen, and it consequently will also contribute to the environmental conservation.

4. Meanwhile, as part of the goal of the M/P (citizens' well-being), well-being of all those who work for SWM should also be reminded in the formulation of the M/P.

J.1.2 Target Year

In accordance with the S/W of the Study, the target year for master plan is set up as follows:

Master Plan: Year 2015

Strategic actions to achieve the goals and targets should be, in practice, introduced step by step towards the target year 2015. Therefore, it is recommended to divide the period up to the target year into three phases.

Phase 1: Short term improvement (2003 to 2005)
Phase 2: Medium term improvement (2006 to 2010)
Phase 3: Long term improvement (2010 to 2015)

J.1.3 Policies

In order to lead implementation of the M/P to the goals, policies of the M/P are formed as follows.

Policy 1: Elimination of waste from the living environment, in order to preserve citizens' health

- Policy 2: Establishment of appropriate final disposal system
- Policy 3: Encouragement of waste minimization

J.1.4 Targets

a. Policies and Targets

Under the policies, clear and concrete targets to be achieved are set up. Policies and targets of the M/P are summarized below.

Policies	Targets
Elimination of waste from the living environment	Keeping up waste collection coverageImproving waste collection coverage
Establishment of appropriate final disposal system	 Improving the operation at Cerro Patacon Ensuring final disposal capacity by 2015
Encouragement of waste minimization	 Keeping down waste generation rate (waste generation amount per capita) Introducing separate collection system

Table J-1: Policy and Target of the Master Plan

b. Target Figures

Target figures for the major components that constitute SWM were set as indicated in the table below.

Phase		Present	Phase 1 Phase 2		Phase 3	
Target year		(2001 to 2002)	2005 2010		2015	
P	opulation	725,866/744,448	807,868	944,573	1,132,726	
W	aste generation rate					
Н	ousehold waste (g/person/day)	589.8		590		
С	ommercial					
	Restaurant (g/employee/day)	6,373	6,373			
Others (g/employee/day)		1,918	1,918			
Institutional waste (g/employee/day)		201		201		
Market waste (g/employee/day)		4,178	4,178			
Waste generation amount (ton/day)		1,025	1,102.0	1,262.9	1,443.6	
Waste collection service coverage (%)		92	98	100 (2006)	100	
Waste collection amount (ton/day)		965	1,065.3	1,231.2	1,408.3	
Separate collection ratio (%)		0	0	16.5	50.0	
Separate collection amount (ton/day)		0	0	63.3	222	

Table J-2: Target Figures of the Master Plan

c. Strategies

Strategies to attain the targets are summarized in the table below.

Policies	Elimination of waste from the living environment	Establishment of appropriate final disposal system	Encouragement of waste minimization
Target	 Keeping up waste collection coverage Improving waste collection coverage 	 Improving the operation at Cerro Patacon Ensuring final disposal capacity by 2015 	 Keeping down waste generation rate Introducing separate collection system
Technical system	 Management of basic data Improvement of collection efficiency Improvement of street sweeping Expansion of collection area 	 Improvement of current landfill operation Expansion of landfill at Cerro Patacon final disposal site 	 Education program for waste minimization and recycling Establishing recycle market mechanisms
 Management system Improvement of DIAMUD's management Cooperation with Juntas Comunales and Juntas Locales Improvement of the private sector participation 		s Locales	
Legal and institutional system	 Preparation of municipal regulations on solid waste management Establishment of a committee regarding MSWM Establishment of policy on waste minimization and resource conservation 		aste management / and resource
 Social consideration (Waste-pickers, employees of DII Environmental consideration (final disposal site, clanded dumping, Lake Alajuela, Panama Bay) 		s of DIMAUD, the poor) , clandestine/illegal	

Table J-3: Strategy for the Master Pla	an
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J.1.5 Outline of the Master Plan

Table J-4 shows contents of the master plan.

Item			Present (2002)	Phase 1(2005)	Phase 2 (2010)	Phase 3 (2015)
Ge	eneral inforn	nation	l	l	l	l
	Population (Panama)		744,448	807,868	944,574	1,132,726
	Service co	verage (%)	92	98	100 (2006)	100
Wa	aste generat	ion amount (to	n/day)	1	1	1
	Total (ton/d	lay)	1,025	1,102	1,263	1,444
	Household	waste	439	476	557	669
	Commercia and industr	I, institutions ies	421	459	534	596
	Market was	ste	24	24	24	24
	Bulky waste	9	12	14	19	26
	Street swee	eping waste	8	8	8	8
	Hospital wa	iste	20	20	20	20
	Demolition	waste	96	96	96	96
	Sewage		5	5	5	5
	Potential re	cyclable waste	293	328	385	444
	Non-recycla	able waste	714	786	909	1,047
Dis	scharge and	l storage				
	Discharge	Separate	0 %	0 %	16.5%	50%
	manner	Mixed	0 %	0 %	83.5%	50%
	Discharge	Total	965	1,065	1,231	1,408
	amount	Separate	0	0	63	222
	(ton/day)	Mixed	965	1,065	1,168	1,186
	Recycling an	nount (ton/day)	0	0	27	94
Co	llection and	l transport				
	Collection system		Collection vehicle	Collection vehicle	Collection vehicle	Collection vehicle
	Transport s	system	Collection vehicle	Collection vehicle and transfer station	Collection vehicle and transfer station	Collection vehicle and transfer station
Fa	cilities					
	Transfer station		-	Installation and operation	Operation	Operation
	Material Re	covery Facility	-	-	Installation, opera	ation, expansion
Fir	Final disposal					
	Final disposal site		Cerro Patacon	Cerro Patacon	Cerro Patacon	Cerro Patacon
			Sanitary landfill and control dumping		Sanitary landfill	
	Disposals	Panama	965.0	1,065.3	1,204.0	1,314.1
		San Miguelito	216.7	250.0	320.3	393.5
	(ton/day)	Arraijan	27.4	39.0	70.5	122.8
		Total	1,209.1	1,354.3	1,594.8	1,830.4

Table J-4: Outline of the Master Plan

J.1.6 **Proposed Improvement Measures**

Proposed improvement measures corresponding to the strategies, which are contents of the M/P, are shown in the tables below.

		Table J-5: Proposed Improvement Measures (1)
Strategies Contents (Proposed Improvement Measures)		
	Basic	Basic database, which is necessary for planning, implementation, monitoring, evaluation and
	Database	1) Proparation of collection area and route man
	Establishment	acquisition and update of maps
	and	 clarification of collection areas and routes on the maps
ection System and Transport System	Maintenance	 2) Establishment of methods of information gathering, accumulation, analysis and evaluation establishment of methods of gathering, accumulation, analysis and evaluation of the weighbridge's data at Cerro Patacon Final Disposal Site preparation of manual of T&M survey preparation of a form of daily working report
	Improvement of Collection Efficiency	 Definition of collection areas and routes definition of collection areas according to Corregimientos definition of collection routes according to Corregimientos definition of roads and public spaces for sweeping (manual, mechanical) Establishment of collection work standards loadage per trip by vehicle type nos. of personnel per vehicle type nos. of working shifts collection methods for each type of discharger or area collection amount (ton/vehicle/hour, ton/worker/hour) Improvement of corresponding measures to emergency and supervision of vehicles equipping GPS on vehicle preparation of street sweeping Improvement of vehicle maintenance preparation of maintenance program keeping up and improving mechanics' capability (employment of qualified person,
ö		 training program) examination of maintenance method (maintenance contract, lease contract, etc.)
	Expansion of Collection Area (measures coping with the expanding urbanized areas to the north and east)	 Examination of transfer transport examination of transfer type (setting large containers, construction of transfer station) planning of transfer transport (cooperation with Corregimientos, introduction of the private sector) Introduction of transfer transport designing of transfer station construction of transfer station construction of collection works clarification of roles of Corregimientos in collection works (e.g. collection by DIMAUD and transport by Corregimientos) examination of possible roles in collection works for introduction of the private sectors
	Special collection for ICIs	Establishment of a special collection system for ICIs waste

- 51 + 1.4. (4) -

Strategies		Contents (Proposed Improvement Measures)
Final Disposal	Improvement of Current Landfill Operation Measures	 1) Establishment of information gathering, accumulation, analysis and evaluation waste amount brought into Cerro Patacon (weighbridge's data) settlement of landfill (by topographic survey) amount of soil used estimation and planning of soil acquisition (by topographic survey) environmental information (leachate, landfill gas) waste amount and composition survey manual 2) Establishment of standards for landfill works will keep quality of landfill operation 3) Improvement of safety of waste-pickers' works consultation with waste-pickers establishment of rules with waste-pickers registration of waste-pickers (issuing identification card to waste-picker) 4) Improvement of leachate treatment installation of pumps to raise up leachate to the lagoon 5) Improvement of landfill gas treatment 6) Urgent improvement of medical waste disposal method
	Ensuring final disposal capacity by 2015	 separation from general waste disposal operation In order to ensure the appropriate final disposal in the municipality, it is recommended to take the following measures. Currying out survey, planning, designing of facilities for ensuring final disposal capacity within the Cerro Patacon site (Feasibility Study) Implementation of the above plan
	Waste minimizati say that a compr incentives, laws a with in the improv	ion and resource conservation cannot be overcome only by technical system. It is needless to rehensive approach, increasing citizens' awareness on environment, introduction of economic and regulations to facilitate, and so forth, is necessary. Such comprehensive approach is dealt vement of institutional system later.
Waste Minimization and Resource Conservation	Education Program for Encouraging Waste Minimization and Recycling Waste Separation /Material Recovery	 Preparation of education program for schools preparation of education program preparation of education materials training on teachers Experimental implementation of the education program is for examining validity of the program Implementation of the education program will be conducted by the Panamanian side Preparation of education program for communities preparation of education program preparation of education program preparation of education materials training on community leaders or NGO Experimental implementation of the education program is for examining validity of the program preparation of the education program will be conducted by the Panamanian side Training on community leaders or NGO Experimental implementation of the education program will be conducted by the Panamanian side Planning of experimental separate collection/material recovery system separate discharge at public institutions and/or schools placement of recipient for cans, bottles at supermarkets collection of separated materials collection of separated materials collection of separated materials
		 3) Analysis and evaluation of the experiment 4) Examination of introduction of waste minimization and recycling system materials subject to separate collection necessary facilities

Table J-6: Proposed Improvement Measures (2)

Strategies		Contents (Proposed Improvement Measures)
	In order to function	on the proposed technical system, it is crucial to improve the implementation system.
Improvement of Management System	Improvement of DIMAUD's Management	 1) Establishment of Management Indicators contains order to establishing a management tool, use of indicators is recommendable. The following are measures to be taken. Adjustment the accounting system to technical component (e.g. collection, transport, final disposal, etc.) Establishment of management indicators (application of CEPIS/COSEPRE System) Establishment of methods to monitor and evaluate with the indicators Experimental introduction of the above system Evaluation of the experiment Introduction of the system 2) Establishment of Management Information System In order to realize efficient and effective management, it is very important to exchange information vertically and horizontally in the organization. The following are recommendable measures to facilitate such communication. Clarification of information to be exchanged (e.g. weighbridge's data, management indicators) Establishment of rules to exchange the information (e.g. from which section to which section) Establishment of tools for exchanging the information (e.g. document form, computer network) 3) Human Resource Development In order to keep up and increase capability of an organization, human resource development is necessary. The following measures are recommendable to take. Organizing "Executing Unit" Technology transfer to "Executing Unit" Preparation of management information system Preparation of training program of personnel Implementation of tariff system In order to a prevent tariff system, it is recommended to take the following measures. Examination of tariff system (simplifying tariff categories of ICIs "institutions, commercial and industries") Improvement of tariff collection method (direct, combination with water supply/electricity, etc.) Examination of tariff collection rate from ICIs preparation of i

Table J-7: Proposed Improvement Measures (3)

	Strategies	Contents (Proposed Improvement Measures)
plementation System	Cooperation with Corregimientos	 In order to establish communication with citizens, it is recommendable to establish cooperation with Corregimientos that have closer relationship with citizens. 1)Establishment of rules for cooperation with Corregimientos for conveying information from DIMAUD to residents through Corregimientos such as collection day and time, separate collection for conveying information from residents to DIMAUD through Corregimientos such as collection service quality
Improvement of Im	Efficient Use of the Private Sector	 The private sector has potential resources, such as human resource and equipment, which is to be useful in MSWM. In order to use such resources in MSWM appropriately, it is recommended to take the following measures. Examination of contract and supervision manner with the private sector Registration of qualified private companies for collection service and disposal works Introduction of the private sector in MSWM
	In order to functi very important.	on MSWM appropriately, legal and institutional system that give regulatory framework is also
al system	Municipal Regulations on SWM	 In order to maximize citizens' benefit and make policy on MSWM firmly, the following measures are recommendable to take. Preparation of municipal regulations on SWM Enforcement of the municipal regulations
nd institution	Establishment of a Committee regarding MSWM	In order to construct a consensus on MSWM, it is recommendable to set up a committee consisting of various types of stakeholders. Establishment of a committee on MSWM (members from Panama Municipality, DIMAUD, Corregimientos)
Improvement of legal a	Establishment of Policy on Waste Minimization and Resource Conservation	 The followings are recommendable to establish policy on waste minimization and resource conservation. 1) Suggestion for policy establishment economic incentives (e.g. deposit system for cans and bottles, tariff system imposing more on large dischargers, etc.) laws or regulations education (e.g. establishment of environmental curriculum in the compulsory education) recycling in factories waste exchange within industries 2)Establishment of policy on waste minimization and resource conservation

Table J-8: Proposed Improvement Measures (4)

J.1.7 Future Waste Stream

Future waste stream shows

Figure J-1, Figure J-2 and Figure J-3.



Figure J-1: Waste Stream in 2005



Figure J-2: Waste Stream in 2010



Figure J-3: Waste Stream in 2015

J.2 Description of the Master Plan

J.2.1 Waste Collection Coverage Improvement

Provision of waste collection service to the whole citizens of Panama District, or achievement of 100% collection coverage, is one of missions assigned to DIMAUD by the mayor of Panama Municipality. As of the end of 2001, the collection coverage was about 92%. Rising up the collection coverage 2% in every year, it will reach to 100% in 2006.

J.2.2 Recycling System

a. Concept of Recycling System

Waste minimization includes Generation control, Discharge control and Resource recovery as shown in the figure below. It will not be successful until achieving dischargers' better understanding and cooperation and also managing organizations' capacity building.



Figure J-4: Concept of Waste Minimization

In this concept, it is Resources recovery only that is handled through the MSWM, i.e., introduction of separate collection and formation of market mechanism for recovered resources.

At present, the resource recovery is undertaken by waste-pickers in the streets and the final disposal site. The recovered materials are provided from junk dealers to recycling manufacturers, and finally to ultimate customers. This kinds of recycling activities are commonly seen both in developing and semi-developed countries. As long as people can

manage to live on the activity, a recycle market is spontaneously formed although security and sanitary problems of waste-pickers who directly collect materials remain. However, as economy grows and people's income level increases, the activity gradually becomes inactive. In this case, administration side needs to take the responsibility instead of waste-pickers. This concept is shown below.



Figure J-5: Concept of Public Intervention for Resources Recovery

It is impossible to estimate the time of the branch point in this figure. However, considering the Panamanian economy, it is surely the near future and it indicates that DIMAUD take an important action to the resource recovery from this time on. Moreover, for the establishment of the recycle system, a plan from technological, social and legislative aspects will be necessary.

The concept of recycle plan is as follows.

- Successful recycling is not guaranteed, however. Program managers must give special attention to making the program economically efficient and maximizing public participation.
- Establishing an effective recycling program presents a major administrative and political challenge to a community.
- In successful programs, procedures are continually reviewed and adjusted according to changing conditions.
- Program managers should continually strive to provide a consistent stream of high-quality (free of contaminants) recovered materials that meet the standards of the marketplace.

source : Decision-Makers' Guide To Solid Waste Management, Volume II, 1995, US EPA

The following figure shows a procedure to make the concept practical, the relation with this study and roles played by DIMAUD as an execution organization of the recycle program.



Figure J-6 : Approach Sequence of Recycling Program

As shown above, basic matters and community education to establish an appropriate recycle system in Panama municipality will be initiated through this study, and then, DIMAUD will take over the recycle program based on the results of this study.

J.2.3 Technical System

a. Discharge and Storage System

There is no particular rule in the present discharge and storage system so that people discharge waste at any time they want using their own containers. Having no particular discharge time causes disorder of waste keeping at a certain place because some waste may have been kept longer than the other before being collected. Consequently, it makes street cleaning and collection service difficult.

On the other hand, introduction of separate collection is proposed in the M/P. It requires discharge manners of dischargers in terms of discharge time as well as separate storage. In the M/P, separation into two waste types is proposed, i.e., recyclable and non-recyclable. Details are given below.

Category	Name of Waste
	Paper
Populabla	Plastic
Recyclable	Metal
	Bottle and glass
	Kitchen waste
	Textile
Non roovalable	Grass and wood
Non-recyclable	Rubber leather
	Soil and stone
	Others

Table J-9: Separate Collection Item

According to this discharge classification, dischargers are requested only to keep recyclable materials in other containers, so that the plastic bags many dischargers are currently using as discharge containers can be directly used.

Therefore, dischargers can perform separate collection without preparing any special containers. However, the classified two wastes should be collected respectively. Storage time for some waste will become longer than the present mixed collection, e.g. the present every day collection becomes every other day collection of non-recyclable waste and every third day collection of recyclable waste. This will be a negative impact for dischargers. Therefore, dischargers' understanding and cooperation need be asked through community education.

b. Collection and Transport System

b.1 Improvement of Collection Efficiency and Street Sweeping

b.1.1 Collection Efficiency

The results of the pilot project of Collection Improvement tells that costs for collection works can be reduced by 21% with manners applied in the same pilot project. DIMAUD will expand this pilot project to other areas and improve collection efficiency with experiences obtained from the pilot project and the manual prepared by the Study Team.

b.1.2 Street Sweeping

Manual sweeping is applied to clean the streets at present. It is not efficient from a technical viewpoint. However, this manual sweeping is carried out as a kind of measures to counter unemployment. Actually, the central government subsidizes about 2 million US dollars every year for this activity. Therefore, it is necessary to take into account this social issue, when efficiency of the street sweeping is discussed.

The Study Team has prepared a guideline based on diagnosis of the present street sweeping works in order to improve its efficiency. DIMAUD will follow the guideline.

Meanwhile, when job opportunities are increased with economic growth, labor forces will move to more economically efficient and effective activities, then it will be inevitable to introduce a mechanical sweeping system. DIMAUD, in the near feature, should prepare such situation.

b.2 Collection System

Collection system is planned on the assumption that the two types separate collection will be implemented in the year 2007. The following table shows separate collection amount.

													Unit: t	ion/day	<i>i</i>
Item	Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Waste amount (to	collection on/day)	964.9	994.9	1,028.9	1,065.3	1,107.9	1,141.9	1,170.0	1,200.7	1,231.2	1,264.0	1,297.3	1,333.1	1,369.2	1,408.4
Potential Recyclable waste amount		293.4	303.7	315.2	327.8	342.4	354.2	. 364.1	374.2	384.7	395.9	407.0	418.9	431.2	444.1
Separate	Overall	0.0	0.0	0.0	0.0	0.0	11.7	24.0	37.0	63.5	91.5	120.9	152.1	185.0	222.1
collection amount	DIMAUD	0.0	0.0	0.0	0.0	0.0	9.7	20.0	30.9	52.9	76.2	100.9	126.9	154.6	185.6

Table J-10: Separate Collection Amount

b.2.1 Required Number of Collection Vehicles

The ordinary compactors are to be used for recyclable waste collection. The number of collection vehicles will be determined based on loading capacity, compaction efficiency and the number of trips per day. The more number of vehicles will be needed to collect recyclable waste than collecting the same weight of mixed waste because of low bulk density and low compaction efficiency of the recyclable waste. In the M/P, the following parameters are used to estimate the number of collection vehicles.

Table J-11: Assumption of Collection Vehicle Conditions

	Mixed collection or Non-recyclable waste	Recyclable waste
Type of vehicle	16 yd ³ Compactor truck	16 yd ³ Compactor truck
Loading volume (m ³)	12.24	12.24
Daily trip (nos./day)	2.5*	2.5*
Compaction ratio	3	2

notes : * average value of DIMAUD collection vehicle is 2.519 trip/day (Jan.2001 to July 2002 from Cerro Patacon weighing data)

b.2.2 Bulk Density

Average bulk density of waste by both discharge sources and physical composition is shown below. The data was obtained from the waste amount and composition survey conducted in the dry season.

							0	nit: kg/liter	
		Household		Comm	nercial	1	Marilant	Street	
	High income	Middle income	Low income	Restaurant Others		Institutional	Market	sweeping	
Kitchen Waste	0.56	0.65	0.65	0.50	0.44	0.65	0.51	0.49	
Paper	0.10	0.10	0.11	0.15	0.05	0.06	0.10	0.07	
Textile	0.29	0.45	0.32	1.65	0.19	0.07	0.28	0.16	
Grass Wood	0.08	0.09	0.12	0.23	0.15	0.10	0.40	0.10	
Plastic	0.08	0.05	0.05	0.05	0.02	0.02	0.05	0.06	
Rubber Leather	0.43	0.17	1.67	NA	NA	NA	NA	0.30	
Metal	0.26	0.15	0.18	0.12	0.21	0.22	0.52	0.13	
Bottles Glass	0.96	1.38	1.18	0.86	0.87	0.68	3.18	1.54	
Soil Stone	0.67	0.43	1.44	NA	2.94	NA	NA	1.11	
Others	0.12	0.25	0.69	NA	0.16	0.29	0.52	NA	
Weighing	0.14	0.18	0.17	0.00	0.00	0.00	0.00	0.10	
average	Weig	hing average	e 0.17	0.20	0.06	0.06	0.22	0.10	

Table J-12 : Bulk Density of Waste

Considering the bulk density of waste shown above, impurity rate and waste composition of other waste under separate collection, the bulk density of recyclable and non-recyclable waste is recalculated in the table below.

	Impurity	Hous	ehold (ton	/day)	Commercial	(ton/day)	Institutional	Market	Street
	rate	High income	Middle income	Low income	Restaurant	Others	(ton/day)	(ton/day)	Sweeping (ton/day)
Kitchen Waste	0.2	4.8	24.0	12.4	9.9	5.8	0.8	3.0	0.0
Paper	0.5	9.2	22.8	12.5	17.4	21.6	8.6	1.9	0.0
Textile	0.2	1.1	1.5	2.7	0.3	0.4	0.0	0.1	0.0
Grass Wood	0.2	1.4	2.2	1.3	0.0	0.6	0.1	0.1	0.0
Plastic	0.5	5.7	10.7	8.1	4.3	11.9	1.2	0.8	0.0
Rubber Leather	0.5	0.5	0.1	2.2	NA	NA	NA	NA	0.0
Metal	0.5	1.2	3.7	3.1	1.0	3.2	1.3	0.3	0.0
Bottles Glass	0.5	1.7	5.7	3.3	5.0	3.4	1.0	0.7	0.0
Soil Stone	0.5	0.1	0.1	0.3	NA	0.5	NA	NA	0.0
Others	0.5	0.0	0.3	0.2	NA	0.3	0.0	0.0	0.0
Total	-	25.7	71.0	46.0	37.9	47.6	13.2	6.9	0.0

Table J-13 :Estimated Recyclable Waste Amount in 2002

Unit[.] ka/liter

	Impurity	Hou	sehold (ton/	day)	Commercial	(ton/day)	Institutional	Market	Street Sweeping
	rate	High income	Middle income	Low income	Restaurant	Others	(ton/day)	(ton/day)	(ton/day)
Kitchen Waste	0.8	19.3	95.9	49.5	39.5	23.1 3.3		12.0	1.2
Paper	0.5	9.2	22.8	12.5	17.4	21.6 8.6		1.9	2.1
Textile	0.8	4.4	5.9	10.9	1.3	1.8 0.2		0.5	0.3
Grass Wood	0.8	5.6	8.9	5.1	0.1	2.3	0.5	0.4	1.8
Plastic	0.5	5.7	10.7	8.1	4.3	11.9	1.2	0.8	1.4
Rubber Leather	0.5	0.5	0.1	2.2	NA	NA NA		NA	0.1
Metal	0.5	1.2	3.7	3.1	1.0	3.2 1.3		0.3	0.2
Bottles Glass	0.5	1.7	5.7	3.3	5.0	3.4	1.0	0.7	0.5
Soil Stone	0.5	0.1	0.1	0.3	NA	0.5	NA	NA	0.7
Others	0.5	0.0	0.3	0.2	NA	0.3	0.0	0.0	0.0
Total		47.6	154.0	95.1	68.6	68.0	16.1	16.6	8.4

					• • •	~ ~ ~ ~
Table .I-14 ·	Estimated	Non-recy	<i>v</i> clable	Waste	Amount in	2002
	Loundtoa	11011100	yolubic	vvuolo .	/ unount m	2002

Table J-15:	Estimated	Bulk Density
	Loundtoa	Durk Denoity

		Household		Comm	nercial			Street Sweeping	
	High income	Middle income	Low income	Restaurant	Others	Institutional	Market		
Recyclable waste	0.13	0.13	0.13	0.16	0.05	0.06	0.16	-	
Other than recyclable waste	0.16	0.16 0.20 0.21 0.23 0.07 0.0		0.07	0.26	0.10			
Whole waste	0.14	0.18	0.17	0.20	0.06	0.06	0.22	0.10	

b.2.3 Future Waste Collection Amount and Volume

The following table shows estimation of DIMAUD's future waste collection amount and the waste collection amount of both recyclable and non-recyclable waste taking the impurity rate into account.

													unit	ton/day
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Household	373.8	392.0	411.5	432.1	454.0	468.0	482.8	498.7	515.5	533.4	552.7	573.1	595.0	618.2
Restaurant	79.0	81.0	83.3	86.0	89.5	93.0	95.3	97.7	100.0	102.4	104.7	107.1	109.4	111.7
Other than restaurant	85.9	88.0	90.6	93.5	97.3	101.1	103.6	106.2	108.8	111.3	113.8	116.4	118.9	121.5
Institutional waste	21.8	22.4	23.0	23.8	24.7	25.7	26.3	27.0	27.6	28.2	28.9	29.6	30.2	30.8
Industrial waste	107.6	110.2	113.5	117.2	122.1	126.9	130.1	133.4	136.6	139.8	143.0	146.3	149.5	152.8
Market	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4
Street sweeping	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
Sub-total	699.9	725.4	753.7	784.4	819.4	846.5	869.9	894.8	920.3	946.9	974.9	1,004.3	1,034.8	1,066.8
Hospital (inc. common waste)	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1
Bulky waste	9.5	9.9	10.9	11.1	12.2	13.3	13.6	14.9	15.3	16.6	17.3	18.8	19.4	21.2
Chatarra (large bulky)	0.7	0.7	0.8	0.8	0.9	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.4	1.6
Despojos (small bulky)	8.8	9.2	10.1	10.3	11.3	12.3	12.6	13.8	14.2	15.4	16.0	17.4	18.0	19.6
Caliche (demolition waste)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Sub-total	30.7	31.1	32.1	32.3	33.4	34.5	34.8	36.1	36.5	37.8	38.5	40.0	40.6	42.4
Total	730.6	756.5	785.8	816.7	852.8	881.0	904.7	930.9	956.8	984.7	1,013.4	1,044.3	1,075.4	1,109.2

Table J-16: Total DIMAUD Collection Amount

													unit	: ton/day
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Household	0.0	0.0	0.0	0.0	0.0	5.4	11.2	17.4	29.9	43.3	57.7	73.0	89.7	108.4
Restaurant	0.0	0.0	0.0	0.0	0.0	1.1	2.2	3.4	5.8	8.3	10.9	13.7	16.5	19.7
Other than restaurant	0.0	0.0	0.0	0.0	0.0	1.2	2.4	3.7	6.3	9.1	11.9	14.8	17.9	21.3
Institutional waste	0.0	0.0	0.0	0.0	0.0	0.3	0.6	0.9	1.6	2.3	3.0	3.8	4.5	5.4
Industrial waste	0.0	0.0	0.0	0.0	0.0	1.5	3.0	4.6	7.9	11.4	14.9	18.7	22.6	26.7
Market	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.8	1.4	1.9	2.4	2.9	3.6	4.1
Street sweeping	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sub-total	0.0	0.0	0.0	0.0	0.0	9.8	19.9	30.8	52.9	76.3	100.8	126.9	154.8	185.6
Hospital (inc. common waste)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulky waste	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chatarra (large bulky)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Despojos (small bulky)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caliche (demolition waste)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sub-total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.0	9.8	19.9	30.8	52.9	76.3	100.8	126.9	154.8	185.6

Table J-17:DIMAUD Recyclable Waste Collection Amount

Table J-18: DIMAUD Non-Recyclable and Mixed Waste Collection Amount

					,								unit :	ton/day
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Household	373.8	392.0	411.5	432.1	454.0	462.6	471.6	481.3	485.6	490.1	495.0	500.1	505.3	509.8
Restaurant	79.0	81.0	83.3	86.0	89.5	91.9	93.1	94.3	94.2	94.1	93.8	93.4	92.9	92.0
Other than restaurant	85.9	88.0	90.6	93.5	97.3	99.9	101.2	102.5	102.5	102.2	101.9	101.6	101.0	100.2
Institutional waste	21.8	22.4	23.0	23.8	24.7	25.4	25.7	26.1	26.0	25.9	25.9	25.8	25.7	25.4
Industrial waste	107.6	110.2	113.5	117.2	122.1	125.4	127.1	128.8	128.7	128.4	128.1	127.6	126.9	126.1
Market	23.4	23.4	23.4	23.4	23.4	23.1	22.9	22.6	22.0	21.5	21.0	20.5	19.8	19.3
Street sweeping	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
Sub-total	699.9	725.4	753.7	784.4	819.4	836.7	850.0	864.0	867.4	870.6	874.1	877.4	880.0	881.2
Hospital (inc. common waste)	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1
Bulky waste	9.5	9.9	10.9	11.1	12.2	13.3	13.6	14.9	15.3	16.6	17.3	18.8	19.4	21.2
Chatarra (large bulky)	0.7	0.7	0.8	0.8	0.9	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.4	1.6
Despojos (small bulky)	8.8	9.2	10.1	10.3	11.3	12.3	12.6	13.8	14.2	15.4	16.0	17.4	18.0	19.6
Caliche (demolition waste)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Sub-total	30.7	31.1	32.1	32.3	33.4	34.5	34.8	36.1	36.5	37.8	38.5	40.0	40.6	42.4
Total	730.6	756.5	785.8	816.7	852.8	871.2	884.8	900.1	903.9	908.4	912.6	917.4	920.6	923.6

b.2.4 Required Number of Collection Vehicles

Based on the aforementioned results and the results of future waste amount estimation, initial volume of separated waste will be calculated, and then, using the parameters for collection vehicles, the number of collection vehicles required in future will be estimated in the table below.

													unit :	m³/day
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Household	0.0	0.0	0.0	0.0	0.0	14.3	28.2	44.3	75.9	109.7	145.9	184.8	228.1	274.7
Restaurant	0.0	0.0	0.0	0.0	0.0	7.3	14.3	22.3	37.7	53.9	70.8	89.2	107.5	127.9
Other than restaurant	0.0	0.0	0.0	0.0	0.0	7.9	15.5	24.2	41.1	59.3	77.7	96.1	116.8	138.2
Institutional waste	0.0	0.0	0.0	0.0	0.0	2.0	3.9	5.8	10.4	15.1	19.6	24.6	29.4	35.1
Industrial waste	0.0	0.0	0.0	0.0	0.0	9.9	19.5	29.5	51.6	74.5	96.8	121.9	147.0	174.1
Market	0.0	0.0	0.0	0.0	0.0	0.6	0.9	1.5	2.6	3.6	4.5	5.4	6.8	7.7
Street sweeping	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.0	42.0	82.3	127.6	219.3	316.1	415.3	522.0	635.6	757.7

Table J-19: Recyclable Waste Collection Volume

Table J-20: Non-recyclable Waste Collection Volume

													unit :	m³/day
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Household	0.0	0.0	0.0	0.0	0.0	19.0	37.5	58.9	100.9	145.8	194.0	245.6	303.2	365.1
Restaurant	0.0	0.0	0.0	0.0	0.0	7.8	15.3	24.0	40.6	58.1	76.3	96.0	115.7	137.7
Other than restaurant	0.0	0.0	0.0	0.0	0.0	9.0	17.6	27.5	46.7	67.6	88.5	109.5	133.0	157.5
Institutional waste	0.0	0.0	0.0	0.0	0.0	2.3	4.5	6.6	11.9	17.1	22.2	28.1	33.3	39.9
Industrial waste	0.0	0.0	0.0	0.0	0.0	11.3	22.2	33.6	58.6	84.9	110.1	138.6	167.0	197.8
Market	0.0	0.0	0.0	0.0	0.0	0.8	1.3	2.2	3.8	5.1	6.5	7.8	9.7	11.1
Street sweeping	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.0	50.2	98.4	152.8	262.5	378.6	497.6	625.6	761.9	909.1

Table J-21: Other Than Separate Collection Volume

													unit	: m°/day
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Household	2,211.8	2,319.5	2,434.9	2,556.8	2,686.4	2,736.0	2,791.1	2,847.6	2,873.4	2,900.5	2,930.3	2,960.4	2,989.1	3,017.9
Restaurant	963.4	987.8	1,015.9	1,048.8	1,091.5	1,120.5	1,135.5	1,149.8	1,148.8	1,147.6	1,144.0	1,138.9	1,132.7	1,122.5
Other than restaurant	1,047.6	1,073.2	1,104.9	1,140.2	1,186.6	1,218.1	1,234.3	1,249.8	1,249.8	1,246.0	1,242.1	1,239.2	1,231.1	1,222.4
Institutional waste	265.9	273.2	280.5	290.2	301.2	309.6	313.3	318.4	317.1	315.7	315.8	314.8	313.4	309.9
Industrial waste	1,312.2	1,343.9	1,384.1	1,429.3	1,489.0	1,529.0	1,550.1	1,571.5	1,569.3	1,565.1	1,562.5	1,555.7	1,547.9	1,537.3
Market	104.8	104.8	104.8	104.8	104.8	103.4	102.6	101.2	98.5	96.3	94.0	91.8	88.7	86.5
Street sweeping	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4
Total	5,991.1	6,187.8	6,410.5	6,655.5	6,944.9	7,102.0	7,212.3	7,323.7	7,342.3	7,356.6	7,374.1	7,386.2	7,388.3	7,381.9

													unit	: m³/day
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Household	2,211.8	2,319.5	2,434.9	2,556.8	2,686.4	2,769.3	2,856.8	2,950.8	3,050.2	3,156.0	3,270.2	3,390.8	3,520.4	3,657.7
Restaurant	963.4	987.8	1,015.9	1,048.8	1,091.5	1,135.6	1,165.1	1,196.1	1,227.1	1,259.6	1,291.1	1,324.1	1,355.9	1,388.1
Other than restaurant	1,047.6	1,073.2	1,104.9	1,140.2	1,186.6	1,235.0	1,267.4	1,301.5	1,337.6	1,372.9	1,408.3	1,444.8	1,480.9	1,518.1
Institutional waste	265.9	273.2	280.5	290.2	301.2	313.9	321.7	330.8	339.4	347.9	357.6	367.5	376.1	384.9
Industrial waste	1,312.2	1,343.9	1,384.1	1,429.3	1,489.0	1,550.2	1,591.8	1,634.6	1,679.5	1,724.5	1,769.4	1,816.2	1,861.9	1,909.2
Market	104.8	104.8	104.8	104.8	104.8	104.8	104.8	104.9	104.9	105.0	105.0	105.0	105.2	105.3
Street sweeping	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4
Total	5,991.1	6,187.8	6,410.5	6,655.5	6,944.9	7,194.2	7,393.0	7,604.1	7,824.1	8,051.3	8,287.0	8,533.8	8,785.8	9,048.7

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	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Separate cc	llection	case (m ³ /	/day)											
Recyclable waste	0.0	0.0	0.0	0.0	0.0	42.0	82.3	127.6	219.3	316.1	415.3	522.0	635.6	757.7
Non-recycla ble	0.0	0.0	0.0	0.0	0.0	50.2	98.4	152.8	262.5	378.6	497.6	625.6	761.9	909.1
Other than separate collection	5,991.1	6,187.8	6,410.5	6,655.5	6,944.9	7,102.0	7,212.3	7,323.7	7,342.3	7,356.6	7,374.1	7,386.2	7,388.3	7,381.9
Total	5,991.1	6,187.8	6,410.5	6,655.5	6,944.9	7,194.2	7,393.0	7,604.1	7,824.1	8,051.3	8,287.0	8,533.8	8,785.8	9,048.7
Non-separa	te collec	tion case) (m³/day)	<u>.</u>	<u>.</u>		<u>.</u>		<u>.</u>				
Non-separa te collection case	5,991.1	6,187.8	6,410.5	6,655.5	6,944.9	7,187.4	7,379.9	7,583.8	7,789.3	8,001.3	8,221.5	8,452.0	8,686.5	8,931.1
Number of	f vehicle	es (nos.))											
Separate co	llection	case												
Recyclable waste	0	0	0	0	0	1	2	3	4	6	7	9	11	13
Non-recycla ble	0	0	0	0	0	1	2	2	3	5	6	7	9	10
Without separate collection	65	67	70	72	76	77	78	80	80	80	80	80	80	80
Total	65	67	70	72	76	79	82	85	87	91	93	96	100	103
Non-separa	te collec	tion case	•											
Non-separa te collection case	65	67	70	72	76	78	80	82	85	87	89	92	94	97
Difference	0	0	0	0	0	1	2	3	2	4	4	4	6	6

b.3 Transfer and Transport System

Necessity of introduction of transfer and transport system was examined, which is presented in detail in the section of Feasibility Study. Results of the examination say that it is recommendable to introduce the transfer and transport system in the East (Tocumen, Pacora and San Martin), however, it is not recommendable for the North (Chilibre). In this section, a recommended transfer and transport system for the East is presented.

b.3.1 Waste Handling Amount

Table J-24 shows waste collection amount forecast. Table J-25 presents required capacity of a transfer station with taking into account number of operation days, 300 days per year.

Ye	ear	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Pacora	79,175	86,108	93,648	101,848	110,76	120,465	131,01	142,48	154,963	168,53	183,290	199,33	216,79
				<u> </u>		6		4	6		2		9	5
	San Martín	3,990	4,139	4,293	4,453	4,619	4,792	4,970	5,156	5,348	5,547	5,754	5,969	6,191
Population	Tocumen	98,708	104,50	110,63	117,126	123,99	131,276	138,98	147,13	155,770	164,91	174,589	184,83	195,68
			1	3		9		0	6		1		4	1
	Total	181,873	194,74	208,57	223,427	239,38	256,533	274,96	294,77	316,081	338,99	363,633	390,14	418,66
			8	4		4		4	8		0		2	7
Waste Amou	unt (ton/day)	205.2	221.8	240.3	261.0	280.6	299.4	319.5	340.5	362.9	386.8	411.6	438.1	466.0

Table J-24: Forecast of Waste Collection Amount in the East

Table J-25: Required Capacity of Transfer Station in the East

											U	nit: ton	/day
Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Required capacity	250	270	300	320	350	370	390	420	450	480	510	540	570

b.3.2 Outline of the System

Table J-26 shows outline of the recommended transfer and transport system.

Table J-26: Outline of the Transfer and Transport System

Item		Specification				
	Туре:	Direct dump station				
Transfer station	Capacity:	600 ton/day in total				
Transfer station		First phase; 300 ton/day				
		Second phase; 300 ton/day				
	Tractor:	300-350 Hp				
Transport equipment	Trailer:	payload 20 ton, 65 m ³ (85 yd ³) with hydraulic ejector blade				
Collection equipment	t Compactor:12.2 m ³ (16 yd ³) compactor truck					

unit · ton/day

b.3.3 Execution Scheme

Through consultation with the counterpart, construction of the first part of the transfer station is set in year 2004. Then, operation is planed to begin in year 2005. As for the remaining part, it is supposed that construction would be carried out in year 2007 and operation would start in year 2008. The schedule is schematized in Table J-27.

	Item	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Design a	nd supervision	Î				Ĵ								
Phase I	Construction		Ĵ											
	Operation													
Phase II	Construction					\Rightarrow								
	Operation						Ų							

c. Intermediate Treatment System

c.1 Material Recovery Facility (MRF)

c.1.1 Required Capacity

Material Recovery Facility (MRF) is planned to be installed as an intermediate treatment facility. The facility shall be constructed within the Cerro Patacon Final Disposal Site because it is economical to locate facilities adjacently. The following table shows planned input amount of recyclable waste and required capacity of the MRF in each year.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Potential amount	293.4	303.8	315.2	327.8	342.4	354.2	364.1	374.2	384.7	395.9	407.1	418.9	431.2	444.0
Recyclable waste collection amount	0.0	0.0	0.0	0.0	0.0	11.7	24.0	37.0	63.5	91.5	120.9	152.1	185.0	222.0
DIMAUD collection amount (ton/day)	0.0	0.0	0.0	0.0	0.0	9.7	20.0	30.9	52.9	76.2	100.9	126.9	154.6	185.6
MRF Installation plan						25		40		60		60		37
MRF total capacity						25	25	65	65	125	125	185	185	222

Table J-28 : MRF Input Amount

c.1.2 Treatment System

Since recovered materials are paper, metals, aluminum, plastics and bottles, manual sorting line will be the principal equipment in the facility. In addition, materials collected in plastic bags will be taken out manually before the sorting process. A flow sheet of the treatment system is shown below.





c.1.3 Recovery Amount

Based on the flow sheet above, impurity rate and recovery ratio of each waste item brought to the MRF are shown below.

	Impurity rate of MRF input	MRF recovery ratio
Kitchen Waste	20%	0%
Paper	50%	60%
Textile	20%	0%
Grass, Wood	20%	0%
Plastic	50%	60%
Rubber, Leather	50%	0%
Metal	50%	60%
Bottles, Glass	50%	60%
Soil, Stone	50%	0%
Others	50%	0%

Table J-29: Impurity rate and MRF Recovery Ratio

Based on the values shown above and the MRF input amount, material recovery amount is estimated in the following table.

								uni	t : ton/day
	2007	2008	2009	2010	2011	2012	2013	2014	2015
Kitchen Waste	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paper	2.8	5.8	8.8	15.2	21.7	28.8	36.2	44.0	52.6
Textile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grass Wood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plastic	1.2	2.5	3.9	6.6	9.4	12.5	15.8	19.2	23.0
Rubber Lather	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Metal	0.4	0.8	1.3	2.1	3.1	4.0	5.1	6.2	7.4
Bottles Glass	0.6	1.2	2.0	3.3	4.6	6.2	7.7	9.5	11.3
Soil Stone	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	5.0	10.3	16.0	27.2	38.8	51.5	64.8	78.9	94.3

Table J-30:MRF Recovery Amount

d. Final Disposal System

Figure J-8 shows the layout of the Cerro Patacon Final Disposal Site. Etapa 1 and Etapa 2 are the existing landfills. It is estimated that those will be full by 2005. The existing landfills have imperfections in view of sanitary landfill. Furthermore, there is no concrete plan to ensure final disposal of waste after 2005. Therefore, this M/P provides plans, i) Improvement of existing landfills and ii) New Landfill Development.



Figure J-8: Cerro Patacon Landfill Site

d.1 Improvement of Existing Landfills

Etapa 1 and Etapa 2 have been used alternately. It is planed that Etapa 1 will be full and closed by the beginning of 2003. Then, Etapa 2 is estimated to operate by 2005 with development of Phase 4 of Etapa 2. Besides, there is another landfill called as *Chatara* where mainly bulky waste is disposed of.

These existing landfills have following problems.

- Daily soil cover is not strictly implemented.
- Leachate collection and treatment systems are functioning insufficiently.

Etapa 1 is to be closed in a few months. Preparation of a plan how to close it properly is an urgent need. Therefore, the M/P provides a plan to meet with the need. Proposed closure manner of Etapa 1 is presented in Figure J-9.



Figure J-9: Closure Procedure of the Existing Landfill

d.1.1 Closure Design of the Existing Landfills

Figure J-10 and Figure J-11 shows closure design; leachate collection system, landfill gas ventilation system and final cover. Etapa 1 and Etapa 2 will employ this closure design.



Figure J-10: Closure Design of the Existing Landfill (1)



Figure J-11: Closure Design of the Existing Landfill

d.1.2 Leachate Treatment System

• Outline of the Present Facility

Figure J-12 shows layout of the existing landfill facilities, or Etapa 1, Etapa 2, *Chatara* and Lagoon.

The lagoon was constructed for treating leachate generated from Etapa 1. However, leachate did not inflow into the lagoon, then, it was not functioning well according to plan (See Table J-31) as of September 2002.



Figure J-12: Layout of the Existing Landfill Facilities
Item	Specifications	Remarks
Type of lagoon	Anaerobic and aerobic	Three step lagoon (3+2+1)
Treatment capacity	40.9 m ³ /day	7.5 gallon/minuets
Influent BOD concentration	7,500 mg/liter	
Effluent BOD concentration	22.5 to 90 mg/liter	
Flow pattern	Plug flow	No.3 > No.2 > No.1
Specification of the lagoon system		
Lagoon No. 3		
Effective surface area	8,400 m ²	
Volume	18,750 m ³	
Effective depth	2.5 m	
BOD surface load	200 to 500 kg/ha/day	
BOD removal rate	50 to 85 %	
Influent BOD concentration	7,500 mg/liter	
Effluent BOD concentration	3,000 mg/liter	
Lagoon No.2		
Effective surface area	7,000 m ²	
Volume	7,500m ³	
Effective depth	2.5 m	
BOD surface load	50 to 200 kg/ha/day	
BOD removal rate	80 to 95 %	
Influent BOD concentration	3,000 mg/liter	
Effluent BOD concentration	450 mg/liter	
Lagoon No.1		
Effective surface area	1,400 m ²	
Volume	2,500 m ³	
Effective depth	2.5 m	
BOD surface load	50 to 200 kg/ha/day	
BOD removal rate	80 to 95 %	
Influent BOD concentration	450 mg/liter	
Effluent BOD concentration	22.5 to 90 mg/liter	

Table J-31	Original Design	Parameter of	Leachate	Treatment	l agoon
	Onginal Design	i arameter ur	Leachale	meatment	Layoon

source : Technical drawings of UNIVERSIDAD TECNOLOGICA DE PANAMA1992

• Leachate Amount and Required Treatment Amount

Leachate volume generated has relations with various factors, such as landfill area, rainfall and sunshine hours. Especially, it heavily depends on rainfall amount. In case where rain season and dry season are clearly divided, facility will have excess capacity when it is designed based on the maximum rainfall, i.e., the facility can meet with the maximum rainfall but no flow will happen in dray season. Then, such facility will become uneconomic. Therefore, the facility should be designed based on yearly water balance and equip a regulation pond. With taking into account the above and based on meteorological data at Balboa Station (rainfall data for the last 10 years and sunshine hour data between 1908 and 1965), water balance calculation was carried out subjecting Etapa 1 and Etapa 2. Consequently, the results say that required capacity becomes the largest at the stage where landfill operation is carried out at Phase 4 in Etapa 2 as shown in Table J-32.

Table J-32: Required Capacity of Leachate Treatment Facility for the Existing Landfills

	Area (ha)	Operation area (ha)	Closed area (ha)	Leachate treatment amount (ton/day)	Required regulation pond volume (m ³)	
Chatarra	5.0					
Etapa I	14.5	-	26.2	-	-	
Etapa II phase 1,2	6.7					
Etapa II phase 3	4.6 (+0.5)*	5.1	30.8	1,000	16,888	
Etapa II phase 4	5.0 (+0.5)*	5.5	35.8	1,200	17,626	
Etapa II phase 5	5.5	5.5	31.7	1,000	18,711	
Medical waste landfill	1.0	-	-	-	-	
Whole closed	37.8	0	37.8	500	18,448	

*: added medical waste landfill area

• Leachate Quality

In designing a leachate treatment facility, it is indispensable to understand leachate quality to be treated. Such data had not existed, then a water quality survey was conducted in the Cerro Patacon Final Disposal Site in January 2002. Table J-33 presents the results of the water quality survey.

According to the result, it is inferred that the present leachate quality is 800 mg/l at BOD and 1,000 mg/l at COD. As the survey was conducted in a dry season, it is conjectured that those concentration will be lower in rain season. For Etapa 1 and Etapa 2 leachate treatment system, the actual results from the Water Quality Survey were used as parameter leachate values in order to account for real conditions, and past and current practices in the landfill.

			Leachate			River water		G	Groundwate	r
ltem	Unit	Ex-	Present	Pond	Dischar	ge point		Car		
nom	Offic	landfill	landfill	1 Ond	Upper	Down	Natural	wash	Upper	Down
		No.3	No.8	No.6	No.5	No.4	No.1	No.9	No.2	No.7
Flow Volume	L/seg	0.00003	0.32	-	0.4	0.4	0.8	-	<0.1	0.95
Groundwater level	m	-	-	-	-	-	-	-	0.52	3.0
PH		6.9	6.9	9.6	6.8	6.7	7.0	7.7	7.1	6.9
Temperature	°C	27.5	34.4	28.9	25.3	28.3	25.0	28.3	28.9	29.9
Conductivity	µS/cm	4130	9120	1255	1172	2140	287	696	1070	4590
Suspended Solids	mg/L	227.2	42	84.4	3.6	38.8	0.8	5.2	30.8	31.6
Turbidity	NTU	321	89.2	164	4.06	46.9	1.1	6.0	20.4	13.5
Color	PtCo	1638	1858	108	35	76	6	0	1	98
Alkalinity	mg/L	453	3192	199	434	440	140	313	302	735
Oil Content	mg/L	1181.0	28.0	434.0	36.0	13.0	14.0	17.0	2.0	35.0
Fecal Coliforms	cfu/100ml	12500	4750	6	20500	2400	520	0	95	30500
Total Coliforms	cfu/100ml	19500	51000	22	54000	5650	755	0	285	250000
BOD₅	mg/L	32.0	762.1	15.7	6.1	36.3	20.5	0	6.8	22.9
COD	mg/L	35.4	1009	20.9	4	54	25	0	0	37.5
Ammonia Nitrogen	mg/L	33.0	491.4	<5.0	8.1	7.8	<5.0	<5.0	<5.0	7.1
Total Nitrogen	mg/L	35.4	495.0	<5.0	9.0	8.2	<5.0	<5.0	<5.0	8.5
Na⁺	mg/L	445.0	490	191.2	82.5	99.0	16.4	111.9	68.0	109.4
Ca ²⁺	mg/L	78.9	245.0	10.8	49.4	69.5	13.7	20.7	69	362.5
HCO3 ⁻	mg/L	553.8	3895.3	181.8	529.7	536.6	170.8	330.9	346.5	896.9
SiO ₂	mg/L	31.8	40.9	17.7	29.5	55.7	50.5	50.6	31.3	83.6
Cl	mg/L	691.3	1181.7	254.1	141.8	336.8	53.2	59.1	100.4	756.3
Ρ	mg/L	620.0	5616.0	365.0	35.0	194.0	79.0	25.0	37.0	92.0
Cd ²⁺	mg/L	0.018	0.035	0.008	0.010	0.017	0.005	0.012	0.008	0.035
CN⁻	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Pb	mg/L	0.35	0.30	0.26	0.24	0.35	0.21	0.22	0.33	0.23
Cr	mg/L	0.0021	0.0054	0.0030	0.0036	0.0018	0.0027	0.0024	0.0021	0.0017
Cr ⁶⁺	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
As	mg/L	0.0046	0.0021	0.0022	0.0033	0.0026	0.0024	0.0030	0.0048	0.0177
Hg	mg/L	0.0010	0.0011	0.0005	<0.0002	<0.0002	<0.0002	0.0010	<0.0002	0.0010
Cu	mg/L	0.262	0.038	0.013	0.015	0.025	0.022	0.025	0.020	0.047
Zn	mg/L	0.117	0.587	0.030	0.042	0.040	0.032	0.443	0.033	0.065
Fe	mg/L	15.720	8.195	0.113	0.420	7.890	0.115	0.063	0.552	0.595
Mn	mg/L	6.272	4.830	0.220	2.987	1.643	0.062	1.272	0.405	3.930
PCB's Aroclor 1016	µg/L	19.9	21.6	ND	ND	ND	ND	ND	ND	ND
PCB's Aroclor 1260	µg/L	41.5	24.8	ND	ND	ND	ND	ND	ND	ND

Table J-33: Results of	of Water	Quality	Survey
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• Leachate Treatment System

ANAM has set standards on effluent to pubic water bodies as show in Table J-34. The planed effluent quality from the lagoon is between 22.5 and 90 mg/l at BOD level which does not meet with the ANAM's standards, as the lagoon was planned and constructed before the standards was in effect.

The effluent standards also regulate harmful substances such as heavy metals. In order to meet with the effluent standards, physical and chemical treatments will be necessary in addition to the lagoon system.

Several alternatives have been analyzed under this Study. The results of the analysis are summarized in Table J-35. Consequently, it was turned out that only Case 4 might meet with the standards.

Item	unit	maximum limit
Biochemical oxygen demand (BOD)	mg/l	35
Chemical oxygen demand (COD)	mg/l	100
Suspended solid (SS)	mg/l	35
Total coliforms	NMP/100ml	1,000

Table J-34 : Discharge Limit to Water Bodies

source : Resolution No. 49 of February 2, 2000. For the control of liquid effluents from domestic, commercial and industrial activities to water bodies

	Treatment process	Treated water quality
Case 0	Only present system	unknown
Case 1	Present lagoon system plus disinfection	unknown
Case 2	Case 1 plus aerator	unknown (may be organic matters are adjust ANAM STD)
Case 3	Case 2 plus chemical treatment	some time exceed ANAM STD
Case 4	Case 3 plus sand filter and activated carbon absorption	may be adjust to ANAM STD

ANMA STD : TABLA 3-1, Normas para Aguas Residuales, ANAM-PAN-BID



Figure J-13: Case 1



Figure J-14: Case 2



Figure J-15: Case 3



Figure J-16: Case 4

d.2 New Landfill Development

d.2.1 Disposal Amount

The following table shows estimated waste collection amount, recycled amount and final disposal amount by the year 2015.

														uniť	t : ton/day
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Waste collection amount	964.9	994.9	1,028.9	1,065.3	1,107.9	1,141.9	1,170.0	1,200.7	1,231.2	1,264.0	1,297.3	1,333.1	1,369.2	1,408.4
Panama	MRF Recovery amount	0.0	0.0	0.0	0.0	0.0	5.0	10.3	16.0	27.2	38.8	51.5	64.8	78.9	94.3
	Waste disposal amount	964.9	994.9	1,028.9	1,065.3	1,107.9	1,136.9	1,159.7	1,184.7	1,204.0	1,225.2	1,245.8	1,268.3	1,290.3	1,314.1
San	Miguelito	216.6	226.4	237.3	250.0	265.3	281.1	293.6	306.6	320.3	334.0	348.1	363.0	378.0	393.5
Arra	ijan	27.4	30.7	34.4	39.0	44.4	50.4	56.3	63.2	70.5	79.0	88.1	98.6	110.3	122.8
	Total	1,208.9	1,252.0	1,300.6	1,354.3	1,417.6	1,468.4	1,509.6	1,554.5	1,594.8	1,638.2	1,682.0	1,729.9	1,778.6	1,830.4

Table J-36: Prospect of Waste Disposal Amount

													unit :	ton/year
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Panama	352,189	363,139	375,549	388,835	404,384	414,969	423,291	432,416	439,460	447,198	454,717	462,930	470,960	479,647
San Miguelito	79,059	82,636	86,615	91,250	96,835	102,602	107,164	111,909	116,910	121,910	127,057	132,495	137,970	143,628
Arraijan	10,001	11,206	12,556	14,235	16,206	18,396	20,550	23,068	25,733	28,835	32,157	35,989	40,260	44,822
Total	441,249	456,981	474,720	494,320	517,425	535,967	551,005	567,393	582,103	597,943	613,931	631,414	649,190	668,097

Table J-37: Prospect of Annual Waste Disposal Amount

Based on the values shown above, supposing;

- unit weight of waste in the landfill is 1.1 ton/m³ and
- required cover soil is 20% of dumped waste,

the final disposal amount accumulated from January 2002 to December 2015 is shown in the following table.

Table J-38: Prospect of Annual Landfill Volume

unit : m³/year 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 Panama 320,172 330,126 341,408 353,486 367,622 377,245 384,810 393,105 399,509 406,544 413,379 420,845 428,145 436,043 San Miguelito 71,872 75,124 78,74 82,955 88,032 93,275 97,422 101,735 106,282 110,827 115,506 120,450 125,427 130,57 9,092 Arraijan 10,187 11,415 12,941 14,733 16,724 18,682 20,971 23,394 26,214 29,234 32,717 36,600 40,747 Cover soil 80,227 83,087 86,313 89,876 94,077 97,449 100,183 103,162 105,837 108,717 111,624 114,802 118,034 121,472 481,363 498,524 517,877 539,258 584,693 601,097 618,973 635,022 652,302 669,743 688,814 708,206 728,833 Total 564,464

Table J-39: Accumulated Landfill Volume

													unit : m°
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Panama	330,126	671,534	1,025,020	1,392,642	1,769,887	2,154,697	2,547,802	2,947,311	3,353,855	3,767,234	4,188,079	4,616,224	5,052,267
San Miguelito	75,124	153,865	236,820	324,852	418,127	515,549	617,284	723,566	834,393	949,899	1,070,349	1,195,776	1,326,347
Arraijan	10,187	21,602	34,543	49,276	66,000	84,682	105,653	129,047	155,261	184,495	217,212	253,812	294,559
Waste total	415,437	847,001	1,296,383	1,766,770	2,254,014	2,754,928	3,270,739	3,799,924	4,343,509	4,901,628	5,475,640	6,065,812	6,673,173
Cover soil	83,087	169,400	259,276	353,353	450,802	550,985	654,147	759,984	868,701	980,325	1,095,127	1,213,161	1,334,633
Total	498,524	1,016,401	1,555,659	2,120,123	2,704,816	3,305,913	3,924,886	4,559,908	5,212,210	5,881,953	6,570,767	7,278,973	8,007,806

Since remaining capacity of the present Cerro Patacon Etapa II Final Disposal Site is expected about 1,800,000m³ by the end of 2002, a new landfill will have to start its operation from the year 2006.

d.2.2 Construction Plan

When the new landfill starts its operation from the year 2006, the expected final disposal amount by the year 2015 is estimated in the following table.

unit · m³

											unit . III	
	2006	2007	2008	2009	20	10	2011	2012	2013	2014	2015	
Waste volume	470,385	957,627	1,458,540	1,974,352	2,503	3,536	3,047,121	3,605,239	4,179,252	4,769,424	5,376,784	
Cover soil volume	94,077	191,525	291,708	394,870	500),707	609,424	721,048	835,851	953,885	1,075,357	
Total	564,462	1,149,152	1,750,248	2,369,222	3,004	1,243	3,656,545	4,326,287	5,015,103	5,723,309	6,452,141	
*Required volume of Etapa 3	286,462	871,152	1,472,248	2,091,222	91,222 2,726		3,378,545	4,048,287	4,737,103	5,445,309	6,174,141	
Service period	Ph	ase 1		Phase 2		F	Phase 3		Phase 4			
Available volume	1,300),000 m ³	1,	200,000 m ³		1,100,000 m ³			2,800,000 m ³			
Total available volume	1,300),000 m ³	500,000 m ³		3,600,000 m ³			6,400	,000 m ³			

Table J-40: Prospect of Required Landfill Volume and Construction Plan

notes : *assumed Etapa 2 remaining volume of end year 2006 is about 278,000 m³

Consequently, the new landfill requires a capacity of approximately 5,400,000m³ for waste volume. In case of including cover soil volume, it becomes about 6,200,000m³. Constructing the landfill with this capacity at once questions on durability of a synthetic liner due to long time exposure to the sunlight. In addition, it enlarges the scale of a leachate treatment facility, which is uneconomical. In this planning, the service period from the year 2006 to 2015 is divided into four steps.

J.2.4 Institutional System

The present institutional system should be adjusted to lead the Panama District to the goal of the M/P, Establishment of Sound Solid Waste Management System.

The M/P sets three major policies in order to achieve the goal. Those are i) elimination of waste from the living environment in order to preserve citizens' health, ii) establishment of appropriate final disposal system and iii) encouragement of waste minimization.

So far, the executing body of SWM in the Panama District, or DIMAUD, had acknowledged that their business principal objective was to collect waste generated from the District. They had not given a large attention to appropriate disposal and waste minimization. Therefore, required capabilities were only waste collection works, street sweeping works and maintenance of equipment. The organization had just corresponded to daily works, in other words, had managed daily crisis.

From now on, DIMAUD should consult on the previous three major policies and attain the targets set under the policies such as improving waste collection coverage, ensuring final disposal capacity by 2015 and keeping down waste generation rate. And, DIMAUD has to acquire capabilities to realize them. Such capabilities are SWM policy planning, high-tech such (transfer and transport, material recovery, sanitary landfilling, etc.), social and environmental consideration and business management. Especially, ability to carry out

"Plan-Do-Check-Action" is crucial for SWM executing bodies, as technical, social, political and natural environments that surround the SWM change as time go on.

Consequently, this institutional system of the M/P aims to strengthen capacity of DIMAUD and organizations and individuals concerned in order to achieve the goal of the M/P, i.e., **"Institutional Capacity Building."**

The Institutional Capacity Building applied in the Study consists of the followings.

- Sector Policy and Regulation
- Organizational Structure Adjustment
- Human Resource Development
- Management Development
- Financial Development

This section describes the contents of the Institutional Capacity Building.

a. Sector Policy and Regulation

This M/P was prepared together with the Panamanian side in order to bring in characteristics of the Study Area, to make the M/P realistic and to strengthen their planning capability, because the M/P needs to be implemented, checked and modified continuously (*Plan-Do-Check-Action*) by themselves.

Besides the M/P, a municipal ordinance was prepared with support of the Study Team, which is under a procedure of approval in the Panama Municipal Council as of November 2002. The ordinance is a tool of establishing a legal framework where the M/P can be appropriately carried out and lead to the goal.

The municipal ordinance stipulates definition of waste to be managed by the Panama Municipality through DIMAUD, responsibilities and roles of the service render (Panama Municipality/DIMAUD) and waste dischargers, private sector participation, service quality, waste minimization and so forth. The following square presents the municipal ordinance.

PANAMA'S MUNICIPAL COUNCIL Republic of Panama, R. P.

MUNICIPAL ORDINANCE No.

As of to , 2002

By which the Urban and Domiciliary Cleansing Service is conformed and regulated, and other provisions related to the management of non-hazardous solid wastes in the district of Panama are pronounced.

PANAMA'S MUNICIPAL COUNCIL

By the power of its legal authority, and

WHEREAS:

Pursuant to the provisions of Article 2 of Law No. 41 dated August 27th, 1999, which transferred the direction, planning, researching, inspection, operation and exploitation of those services linked with cleansing duties in the metropolitan area upon the municipality of Panama;

That number 14 of Article 17 from Law dated 1973, and later on modified by Law 52 dated 1984, sets forth that the Municipal Councils have the solely competence to establish and regulate the urban and domestic cleaning service for their inhabitants, as well as to furnish the means to utilize solid wastes;

That number 9 of Article 76 of the above-mentioned law, establishes that the Municipalities will set and collect rates and fees for rendering the waste collection service;

That article 23 of Law 41 dated August 27th, 1999, empowers the Mayor with the right to regulate the services set forth in Article 2 of the above law through an ordinance;

That it is necessary and fundamental to ensure the compliance with the municipal rules on urban cleansing, so as to manage non-hazardous wastes in the district of Panama in a rightful way;

That the regulations currently in force connected with the management of non-hazardous solid wastes must be rearranged, thus the necessity to group the above mentioned rules around a unique set of laws;

DECREES THE FOLLOWING ORDINANCE CHAPTER I PURPOSE

- Article 1: The ordinance presented herein has the purpose of regulating the relations among the Urban and Domiciliary Cleansing Office (DIMAUD in Spanish), its customers and particular providers, in the rendering of solid waste management services and cleaning in the district of Panama.
- Article 2 It is acknowledged that, in order to have a clean and healthy city, the civil society must actively participate in a responsible and organized manner.

The municipality of Panama will facilitate the creation of Cleansing and Ornament Committees at a neighborhood, urbanization and habitation complexes, with the existing social bodies acting as foundations.

CHAPTER II TYPE OF SOLID WASTES TO BE MANAGED

- Article **Household**. Those wastes generated in residential property due to the normal activities of its inhabitants, with an specific weight of less than 500 kg/m3 (843 lb/yd3) and can be disposed of in plastic bags of up to one hundred (100) liters (26 gallons) or in containers of up to three hundred (300) liters (80 gallons).
- Article **Institutional**. Those wastes generated by the State's offices and facilities, municipalities, autonomous and semi-autonomous public entities, public enterprises and any other state and religious entities.
- Article **Commercial.** Those wastes generated by commercial and mercantile premises such as warehouses, depots, hotels, cafeterias, restaurants, markets, supermarkets, offices, educational centers and the like.
- Article **Industrial.** Those non-hazardous solid wastes generated by the respective activities of this sector, as the outcome of production processes and similar activities.
- Article **Non-hazardous Medical (wastes).** Those wastes generated by the actions of health facilities, such as administrative activities, preparation of food and others, similar to institutional solid wastes that will not pose a risk to human health, ecosystems or the environment.

CHAPTER III MODALITIES OF THE SERVICE

- Article Ordinary service. It has the purpose of managing the following solid wastes:a) Household wastes
- Article **Special Residential Service.** It has the purpose of managing the following solid wastes:
 - a) Those wastes coming from civil construction works, modification or demolition of public or particular real estate, unusable property or wastes from garden pruning and cleaning.
 - b) Other wastes that, given their nature, composition, size and volume should be regarded as special, as per judgment of the municipality of Panama.
 - c) Wastes that pose difficulties in their handling, due to their location and for being inaccessible to collection vehicles.
 - d) Those wastes not regarded in previous clauses that require other special conditions for their management than those of the ordinary service.

Article **Special institutional, commercial and industrial service.** It has the objective of managing the following solid wastes:

- a) Institutional solid wastes
- b) Commercial solid wastes
- c) Non-hazardous industrial solid wastes
- d) Non-hazardous medical wastes

CHAPTER IV RESPONSIBILITIES

- Article **Exclusivity.** The municipality of Panama, through its Urban and Domiciliary Cleansing Office (DIMAUD in Spanish), has the exclusive operation, exploitation and management of the non-hazardous solid waste throughout the district of Panama.
- Article **Compulsoriness.** The solid waste collection and disposal services are obligatory for every inhabitable property, commercial and industrial facility, as well as for all the public and official premises within the district of Panama.
- Article **Responsibility of the Municipality of Panama.** To render the collection, haulage, sweeping, transfer, treatment and final disposal services in conditions that ensure their quality, continuity, regularity and fairness; so that the service is efficiently provided to its customers. Also, To protect public health, preserve the environment and the natural resources and aesthetics and cleanliness within the district.
- Article **Responsibility of Customers and the Public in General.** Every natural or artificial person, public or private (entity), residents or pedestrians, have the obligation to collaborate with the Municipality of Panama in the cleaning duties within the district by reducing the generation of solid wastes, discharging them in the manner and time established for such purpose and paying in time for the service rendered. No littering on public thoroughfare and places is a must.
- Article **Objective Responsibility.** Every natural or juridical person that emits, dumps, disposes or discharges substances or wastes that affect or might affect human health; put the environment into risk or harm it, that harm or might harm the essential ecological processes or the population's living standard will have an objective responsibility for the severe damages that can be caused, pursuant to the special laws related to the environment.
- Article Legitimate Interest of the Municipality of Panama. The General Environmental Law (LEGA) acknowledges the collective and extended interests to actively legitimate any citizen or civil body in the administrative, civil and criminal proceedings due to damages to the environment. The municipality of Panama will make an effective use of this regulation to denounce those who dump, dispose or discharge solid wastes, in opposition to the current ordinance.

CHAPTER V PARTICIPATION FROM THE PRIVATE SECTOR

Article **Permits.** All natural, juridical, public, private, domestic or foreign persons with the interest in rendering storage, collection or haulage services for non-hazardous institutional, commercial or industrial solid wastes generated within the district will have to obtain an Operation Permit from the municipality in advance.

It is established that the municipality of Panama maintain the whole and full exclusiveness to furnish the ordinary solid waste management service, thus assuming its responsibility of protection of public health within the district.

- Article **Registry.** The municipality of Panama will outline the requirements to be met by the private providers of the service to obtain the Operation Permit, and they will keep an updated registry of such permissions.
- Article **Insurance.** Prior to the delivery of the Operation Permit, the applicant will hand in a civil environmental liability insurance to the municipality of Panama, issued by an existing insurance company in the Republic of Panama, as a warranty for the economic compensation that might be caused by the miscarriage of its operations and obligations. The municipality of Panama will set the amount to be insured and the corresponding policy will be in force while the rendering of the services exists.
- Article **Surveillance and Control.** The municipality of Panama assumes the obligation of controlling the rightful performance of private providers of the service, who in turn will follow the operational procedures set forth by the municipality of Panama exactly as they are indicated, to render the services hired by third parties.
- Article **Suspension and Annulment of the Operation Permit.** The municipality of Panama will be able, based on its own criteria, to temporarily suspend or definitively annul the Operation Permit being granted, after considering the violations to the operational proceedings incurred by the transgressor.

CHAPTER VI CLEANING OF PUBLIC THOROUGHFARE AND AREAS

- Article **On the responsibility of sweeping and cleaning of public thoroughfare and areas.** The sweeping and cleaning duties of public thoroughfare and areas will be responsibility of the municipality of Panama, and they will be carried out with the frequency required in order to keep them always clean.
- Article **Public Containers**. The municipality of Panama will place containers for the exclusively storage of solid wastes generated by pedestrians on street curbs, in the amount and capacity required according to the intensity of pedestrian and vehicular transit.
- Article **Collaboration from the Public.** The neighbors will be obligated to keep the front part of their property clean.
- Article **Traveling Sales and fixed stalls.** Peddlers, those with fixed stands on the street and those located in public areas, have the obligation to keep the surroundings of

their stalls clean.

If wastes are generated, given the nature of the products they offer, they will have to place containers accessible to the public to dispose the wastes on their account.

- Article **Special Events.** When special events and shows are conducted to which people assist in great quantities, a waste collection and storage system for the residues generated there will be made available; the organizing entity of the event will coordinate its actions with the municipality of Panama and will pay the cost of such special service in advance.
- Article **Transportation of materials.** Any means of transportation for the carriage of materials will have a lid or cover, in order to prevent public thoroughfare from becoming soiled.

The vehicle will have all the cleaning instruments that ensure an immediate sanitation in the event of the material being scattered.

Article **Loading and unloading of merchandise.** The persons that order, have somebody load or unload materials on public thoroughfare will have to take away the wastes scattered.

In case this event happens, the occupant of the property where the loading or unloading has taken place will be held liable.

Article **On vacant property.** Every owner of a vacant property will keep it clear of weed and any type of solid waste accumulation.

Should the owner fail to comply with this duty or his/her address is unknown, the municipality will clean it and the cost of the operation will be charged upon the property owner. If such service is not paid, after following the corresponding administrative procedure, a compelling jurisdiction procedure will follow

Article **On animals and their defecations.** It is the responsibility from the owner or person in charge of house pets to collect and clean their defecations from public spaces or thoroughfare.

CHAPTER VII STORAGE AND CONTAINERS SECTION I Storage of solid wastes		
Article	Obligations of the customers. The customers of the ordinary solid waste management service will have the following obligations as regards to the storage:	
	 a) To store the solid wastes generated in a sanitary manner, pursuant to what is set forth in the regulations herein. b) Customers will not dispose liquid substances, excrement or solid wastes regarded for a special service in the containers devoted for the ordinary collection service. c) Customers will place the containers at the collection spot, according to the time and day established by the municipality of Panama d) Customers will keep the containers in good conditions. 	
Article	Returnable containers. Returnable containers for the storage of solid wastes will have the following features:	
Article	 a) An appropriate weight and structure that facilitate their handling during the collection works. b) They will be made of impermeable material, such as plastics or metal, easy to clean and protected against corrosion. c) They will have lids that fit properly and will not hinder their emptying during the collection. d) They will be built in such a way that, whenever they are closed or covered, they will prevent the ingress of water, insects or rodents, as well as the draining of liquids through the walls or the bottom end. e) The container's capacity will be established by the municipality of Panama and will meet the generators' needs. 	
	 least one of the following characteristics: a) They will be able to withhold the stress exercised by the solid wastes and the handling. b) Their capacity will be established by the municipality of Panama. c) They will be closed by means of a fixed fastening device or a knot. 	
SECTION II On the collective storage of solid wastes		
Article	Collective storage system. Every facility devoted for multiple-family housing, institutional, commercial or industrial purposes, or others determined by the municipality of Panama, will have an storage system whose characteristics are to be determined by the municipality.	
Article	Requirements. The areas devoted for collective storage in buildings referred to in the previous paragraph will meet at least the following requirements:	

a) The floor, walls and ceiling finishes will be even to allow an easy cleaning and to prevent the creation of favorable environments for insects or microorganisms; their corners between walls and the floor will be rounded. b) They will have effective ventilation, water supply, drainage and firefighting control systems. The municipality of Panama will provide the person in charge of the building c) layout with the minimum dimensions and other requirements to be met by the storage area. When the construction of the building is concluded, the municipality of Panama will conduct an inspection to confirm that the specifications for the storage area have been complied with, and it will issue a certificate that will be part of the conditions to approve the habitability of the building. Article Utilization of ducts. Solid wastes being disposed of by means of ducts will be baled in impermeable containers that meet the characteristics of disposable containers. Article Storage boxes. The buildings referred to in the previous articles that, due to their location, cannot be easily rendered the collection service, will be able to put storage boxes within the property's perimeter. The municipality of Panama will furnish the technical assistance required to solve these situations and to ease the storage and collection of the wastes. Article **Responsibility for the cleansing.** Cleansing of the surroundings of storage boxes for private use will be the sole responsibility of the users. Article **Dimensions.** The municipality of Panama will determine the size, capacity, amount and loading and unloading system of the storage boxes or containers, and their dimensions will correspond to standard sizes, so that they adjust to the collection systems used by the municipality, and they will also meet the generators' needs. **CHAPTER VIII** DISCHARGE Article **Discharge.** The delivery of solid wastes will be carried out in accordance with the instructions by the municipality of Panama. Article Placement of receptacles and containers. The receptacles or containers will be located at the place determined by the municipality of Panama on the programmed schedule. Article Removal of containers. In the ordinary service, the receptacles or containers will be removed from the discharge place, after the collection has been carried out. In case the collection service is not provided, be it for acts of nature or irresistible force, the containers will be returned to their place of origin, until the service is reinstated. Article On hazardous chemical wastes. It is forbidden to discharge or dump chemical products and hazardous materials in solid waste containers devoted for household use, such as the following: sharp objects, oils, lubricants and grease, disinfectants, detergents, solvents, pesticides, raticides, resins, varnish, bleach, paints, wood protectors and chemical products for general cleaning purposes, car accumulators, clock and electronic household appliance batteries.

The municipality of Panama will use the special service for providing the appropriate management of these wastes and hazardous chemical products generated in the houses.

CHAPTER IX COLLECTION

- Article **Responsibility.** It is the exclusive responsibility of the municipality of Panama to pick up all the solid wastes discharged or delivered by its ordinary service customers, as long as the discharge and delivery are made in accordance with the provisions set forth in this ordinance.
- Article **Collection Frequency and Time.** The municipality of Panama will establish the optimal collection time and frequency, so that wastes do not rot or propitiate adverse conditions on people's health or pollute the environment. Any change in the frequency or time to be carried out by the municipality of Panama will be informed to its customers with fifteen days in advance, through the social communication media.
- Article **Collection service.** The collection of solid wastes will be conducted by the municipality of Panama, in accordance with the routes assigned and it will also furnish the required human resources and equipment to meet the schedules, frequencies and quality of the services being offered.
- Article **Scattered or strewn wastes.** In the event that solid wastes are scattered or strewn during the collection process, the persons in charge will immediately pick them up.

The municipality of Panama will furnish all its collection trucks with storage devices to gather the liquids emanating from the compaction of the wastes.

Article **Closed land lots.** When wastes accumulate inside closed land lots due to the absence of people or because the lot is not properly shut, the collection and haulage to the disposal site will be in the hands of the lot's owner. In case the municipality of Panama carries out this collection and haulage, it will be regarded as a special service and will charged upon the lot owner.

Article **Pruning of bushes and gardens.** The municipality of Panama will only remove small amounts from pruning of gardens and bushes, as long as these wastes have been properly conditioned in the containers authorized in this ordinance and facilitate their handling.

The municipality of Panama will not collect pruning wastes that might damage the compaction mechanism of the collection vehicle or put the operators' safety into risk, according to its judgment. The municipality of Panama offers its customers a special service to attend to this need.

CHAPTER X HAULAGE AND COLLECTION VEHICLES

- Article **Vehicles.** The vehicles devoted to the collection and haulage of wastes will meet the proper conditions for this activity and those outlined in the ordinance herein. Its design will comply with the specifications that guarantee the correct rendering of the service, i.e., they must be closed, watertight and easy to unload and be washed. This provision applies to the ordinary and special collection services provided by the municipality of Panama, as well as to private authorized providers.
- Article **Adaptation and replacement.** Those vehicles and pieces of equipment devoted to the transportation of solid wastes that fail to meet the demanded conditions will be adapted or replaced.
- Article **Maintenance.** Maintenance and operation of vehicles devoted to the haulage of solid wastes will be in charge of its owner, whose responsibility cannot be exempted. The vehicles will be in permanent good conditions to render the service.
- Article **Vehicle wash.** At the end of the working day, the vehicles and the equipment utilized will be washed in order to keep them in conditions that will not affect health or aesthetics.
- Article **Circulation.** The vehicles and equipment devoted to the transportation of solid wastes will meet the current circulation and traffic regulations, in order to avoid becoming an obstacle to the circulation of other vehicles or persons.

CHAPTER XI TRANSFER STATIONS

- Article **On the transfer service system.** The establishment of transfer service systems of solid wastes will be subject to the requirements dictated by the competent authority, pursuant to the current set of regulations.
- Article **Selection of the technique and location.** The municipality of Panama is responsible for selecting the technique to be utilized on the transfer systems and their location.
- Article **Requirements of the transfer service system.** Every transfer service system will meet the following requirements at least:
 - a) To have the required and appropriate infrastructure for the integral management of the solid wastes to be transferred.
 - b) To guarantee that its activities will not harm the people's or environment's health and well-being.
 - c) To cut down the global costs for haulage and labor employed in the collection.

CHAPTER XII FINAL DISPOSAL

Article	Final disposal . The final disposal of solid wastes generated in the district of Panama will be at Cerro Patacon sanitary landfill, with the best engineering techniques and observing the current regulations.
Article	Final use of land. The municipality of Panama will have an engineering project that establishes the ultimate use of land filled with solid wastes.
	All the final disposal operations of solid wastes and the construction of infrastructure will attach to the project for the final use of land.
Article	 Acceptable solid wastes. The following are to be accepted for its final disposal at Cerro Patacón sanitary landfill: a) The solid wastes collected by the municipality of Panama in its ordinary and special service; b) The solid wastes generated at the district of San Miguelito that meet the characteristics set forth in this ordinance, always under the direct responsibility of San Miguelito municipality; c) The household solid wastes and similar solid wastes generated by institutions, businesses and industries lying in the district of Panama and transported by authorized suppliers.
	The municipality of Panama reserves the right to allow the entrance of solid wastes that fail to meet the features required before, in special or emergent cases that can be disposed of without damaging the programmed operations. The cost of these special cases will be charged upon the generator of such wastes.
Article	Solid wastes from health facilities. The solid wastes generated in health facilities of the district of Panama that meet the regulations set forth in the Executive Decree No. 111 dated June 23rd, 1999 will be disposed of at the Cerro Patacon sanitary landfill.
Article	Infrastructure. The municipality of Panama will provide the necessary infrastructure at all times, so that the operations are executed without inconvenience and with compliance with the technical regulations.
Article	Entrance registry and control. All the vehicles entering Cerro Patacon sanitary landfill will register. The municipality of Panama will conduct a strict control and registry of the type of vehicle, plates, origin (corregimiento, public or private vehicle), total weight, tare, weight and type of solid wastes, time of entrance and exit and particular remarks. This data will be automatically and immediately forwarded to the control unit at the headquarters of the municipality of Panama.
Article	Discharge, spreading and compaction. Vehicle drivers will unload solid wastes at the place indicated by the official in charge of the unloading operations.
	Solid wastes will be spread in layers between 30 and 50 centimeters, in order to achieve an optimal compaction.
	The cells of compacted solid wastes to be formed will respond to the final use of land project

Article	Daily and final coverage. At the end of daily operations, the cells of compacted solid wastes will be covered with a 30 cm. thick soil layer.
	In the moment a specific zone has reached the final level established in the project for final use of land, such area will be sealed with a structure that ensures water tightness by taking into account incoming rainwater and biogas output.
Article	Biogas. Biogas produced during the stabilization process of organic matter of solid wastes will be gathered as much as possible to use it as an energy source, thus avoiding the impact of its direct emission towards the atmosphere.
Article	Leachate. The municipality of Panama will pay special attention to leachate management originated from sanitary landfill operations. An effective leachate collection, conduction and treatment system will be available. Effluents from the treatment system will meet the dumping regulations established by the competent authority.
Article	Extraction of materials. The extraction of materials in the flow of discharged wastes is prohibited. The municipality of Panama will carry out the required formalities, so that the current extraction practices are eliminated from social considerations.
Article	Perimetrical fence. The municipality of Panama will build a perimetrical fence to the operations zone, with the purpose of enduring the safety and efficacy of the operations.

	CHAPTER XIII MINIMIZATION AND RECYCLING SECTION I On control and reduction of generation
Article	Objective. To develop a society focused on the conservation of resources, through minimization of solid wastes and reuse, reduction and recycling practices.
Article	Participation of the private sector. The municipality of Panama will convene the private sector with the purpose of reducing the packaging flow, with the definition of the latter as every manufactured product to contain, protect, manipulate, distribute and present merchandise, from raw materials to finished items and from the manufacturer to the user or consumer.
Article	Promotion, education and public participation. The municipality of Panama will promote and sustain an educational program that encourages public participation into the effective reduction of solid waste generation within the district.
	The municipality of Panama will also establish the required mechanisms to keep and eventually downsize the generation of solid wastes, including household, institutional, commercial and industrial wastes.
	SECTION II On the recovery and recycling of solid wastes
Article	 Purpose. Recovery and recycling includes three (3) main purposes: a) To recover economic and energetic valuables that have been used during the primary process for the elaboration of products. b) To reduce the amount of solid wastes produced and to be disposed of at Cerro Patacon sanitary landfill. c) To reduce environmental contamination.
	SECTION III On the places where solid wastes can be segregated and stored.
Article	Separation. Separation of solid wastes will only be allowed at the sources of origin and at the sites duly permitted by the competent authority and the municipality of Panama.
Article	Location of recovery centers and recycling facilities. The location of warehouses, gathering centers and recycling plants of solid wastes will go in accordance with the urban planning regulations in force and with the guidelines indicated by the competent authority and the municipality of Panama.
Article	Operating conditions. The operation of warehouses, gathering centers and recycling plants of solid wastes will be conducted, at least, under the following conditions:
	a) To comply with the occupational health, hygiene, industrial security, air, soil

and water pollution control provisions, pursuant to the regulations in force and those pointed out by the competent authority. To keep the facilities and their peripheral areas clear of whatever solid or b) liquid waste that might come off. To ensure the insulation with respect to the surroundings, in order to avoid c) aesthetic problems, proliferation of vectors, rodents or bothersome odors. d) To carry out the unloading and loading operations and recyclable material handling within their facilities. e) Other conditions determined by the competent authority and the municipality of Panama. **CHAPTER XIV ON HUMAN RESOURCES** Article Occupational health. The municipality of Panama will defend its employees' health and safety, and it apply the following measures at least: It will demand the staff working in solid waste management operations to a) have an updated vaccination report. b) It will elaborate working security regulations with the respective indications on the use of equipment. It will provide the personnel with a locker room and showers to clean and c) change their clothes after every workday. d) It will establish a medical examination program that allows the identification and reduction of potential contamination risks related to this activity. It will provide the workers with gauntlets, boots and at least two (2) uniforms e) per year. Any other condition demanded by the competent authority. f) Article Training. Municipality of Panama is obligated to providing continuous training courses to all the employees allocated at operational duties, with the purpose of improving their skills and preventing accidents and labor diseases. CHAPTER XV **ON THE QUALITY OF THE SERVICE** Article Basic program. The municipality of Panama will have basic programs on the means to achieve and sustain performance goals and the service levels established and regarded as acceptable for the provision of the service. These programs are based on previous studies on service needs and will include qualitative and quantitative goals in, at least, the following aspects: Coverage and quality of the sweeping and cleaning service for public a) thoroughfare and areas. Coverage and quality of the collection service. b) Environmental quality of the operations at Cerro Patacon sanitary landfill. c) Minimization of solid wastes, with the participation of the industrial and d) commercial sector. Reduction, reuse and recycling. e) f) Number and outcome of educational campaigns. Fostering the participation of customers in the service g) Results of operational duties h) i) Results of commercial duties Results of economic-financial duties i)

k) Results of public acceptance Article Managerial indicators. The municipality of Panama will use indicators to measure the performance of its activities. The constant comparison of the values obtained will be utilized for decision-making and continuous improvement. Article Information. The municipality of Panama will keep appropriate records of the service rendered and a control and assessment program, whose scope and frequency must be sufficient to establish whether the collection, cleaning and final disposal services of public thoroughfare and areas is being operated and kept, pursuant to the provisions of this ordinance and to the corresponding technical and quality regulations. Article Service Levels. The appropriate quality levels for the services will be as follows: Quality of collection. The service being rendered will comply with the a) regulations set forth in the ordinance herein: a.1 The frequencies and schedules indicated to the customers will be compulsorily met, and any change will be communicated with fifteen days in advance a.2 All solid wastes being discharged in the appropriate manner will be collected, as well as the residues scattered or strewn during such process. a.3 The collection vehicles will meet the proper conditions for this activity and will also be in perfect functional and appearance conditions. a.4 The vehicles will have storage devices for the leachate seeping out from the compaction activities, and the vehicles will be washed at the end of the working day. a.5 The noise level resulting from the operation will be maintained at the lowest level possible, especially during night shifts. a.6 Operators represent the image of the municipality of Panama, and therefore will observe all the politeness and courtesy habits towards the customers and the public in general; they will have their complete uniform and will have the obligation to use the elements for their personal safety provided by the municipality of Panama. a.7 The collection vehicle drivers will strictly meet all the traffic regulations, especially those of speed and parking. b) Quality of public thoroughfare and area cleaning. The service being rendered will meet the regulations established in the ordinance herein: b.1 The frequencies and schedules established will be compulsorily complied with, and any change will be informed to the public. b.2 Roads under this service will be kept clean and will be swept with the required frequency. b.3 The municipality of Panama will install pedestrian containers, as part of the urban furniture. b.4 Solid wastes disposed of in these containers will be collected as necessary. b.5 Bags with solid wastes from sweeping and cleaning of public thoroughfare and areas will be disposed of at the places established for such purpose by the collection service. b.6 It will be verified that fixed commercial stalls located at public areas have the containers required to dispose of the solid wastes generated from their sales. b.7 Cleanliness inspectors, with the powers attributed to them, will demand the cleaning of roads soiled due to the loading and unloading of merchandise, construction works, transportation or materials, animal excrement, vehicle washing, garden pruning and other activities.

b	.8 Operators from the municipality of Panama, as in the previous clause, will be duly uniformed, using their personal safety elements and observing all the courtesy and education norms.
с) Quality of final disposal. The service being rendered will meet the regulations set forth in the ordinance herein:
с	.1 The operations of Cerro Patacon sanitary landfill will be ruled according to
с	.2 The best engineering techniques will be used, aimed at protecting the public health and preserving the environment.
с	.3 All the vehicles that require the final disposal service will be controlled and their entrance registered; they will indicate the weight of solid wastes, their features and origin.
с	.4 The solid wastes will undergo an optimal compaction and will be covered with a soil layer after each day
с	 5 Leachate will be gathered and treated before being discarded, by observing the regulations in force.
с	.6 Biogas will be collected and used to generate energy as much as possible,
с	 The municipality of Panama will conduct all the efforts required to eliminate the extraction of materials with social considerations.
	CHAPTER XVI CUSTOMER SERVICE
Article F a v	Rights of the customers. All natural or artificial persons will be able to have ccess to solid waste management services in the district of Panama, pursuant to what is set forth in the ordinance herein and in applicable provisions.
Г	The customers will have the following rights:
а) To demand the efficient rendering of the services, according to the established quality levels, to the municipality of Panama.
b	To claim the municipality of Panama when it is proved that the former is not complying with the qualitative and quantitative goals
с) To receive information and the appropriate guidance on the services the customer is being rendered, with sufficient detail in order to exercise its right
d	as a customer. To be informed in advance on the changes of collection frequency and schedule
е	To demand information on the approved rate system with sufficient advance,
f	 To claim before the municipality of Panama when alterations on the bills appear that do not coincide with the approved rate system
g	()) To receive the invoices in sufficient advance prior to their due date. The municipality of Panama, or its collecting negotiator, will submit the bills in
h	 the appropriate time and through the ideal means. To be attended by the municipality of Panama with respect to the consultations or claims it poses, in the shortest time possible.
Article C	Obligations of the customer. The owners, possessors and tenants of real state property will be obligated to the following:
а) To comply with the obligations designated in the ordinance herein as regards

to the storage and discharge of its solid wastes to the collection service.

- b) To collaborate with the municipality of Panama in order to keep the district clean.
- c) To pay the bill for the service before its due date, pursuant to the provisions of the rate system.
- Article Releasing of information to the customers. The customers will have information on the existing quality levels of the service, the levels set and the programs to achieve such levels. This information will be periodically issued by the municipality of Panama on a free distribution material, or will be informed to the customer in person or to the Communal Boards of the district of Panama.

All the customers of the municipality of Panama and the public in general have access to the telephone line 800 ASEO, to post their claims and issue their opinion on the quality of the services.

CHAPTER XVII RATES

Article Presentation and approval of the rates listing. The Municipal Council will approve the list of rates for the provision of the solid waste management service.

The rates will be presented on separate lists for the household category in the ordinary and special service, and for institutional, commercial, and industrial customers.

- Article Users, Costs and rates: The rates will be based on appropriate studies and will adjust to the following principles:
 - a) For single-family, multi-family and low-income rented room neighborhoods customers, the rates will be fixed.
 - b) For institutional, commercial and industrial customers, calculation of the rate will be volumetric-wise, in order to encourage efficiency and fairness among customers and to reduce generation. Such service will be rendered by means of a contract.
- Article Periodical reviewing of rates: The rate system will not be in force for less than four (4) years or beyond six (6) years. The DIMAUD will present the list of rates for the following period to the Municipal Council for its approval, within the three (3) previous months to the expiration of the rates in force.
- Article Determination of the rates. The rates will be estimated in accordance with Article 4 of Law No. 41 dated August 27th, 1999.
- Article Automatic rate indexing. During its validity, the rates will be automatically readjusted once (1) a year. The readjusted rates will be applied as from January of the following year.

Information on the variances of the wholesale price index will be provided by the Office of Statistics and Census of the Contraloría General de la República [Comptrollership General's Office of the Republic].

CHAPTER XVIII PAYMENT OF THE SERVICES

- Article Collection of the services. The municipality of Panama will be responsible of collecting the services, or its collecting negotiator. The bills, debt settlements or certificate of indebtedness issued for the services rendered will have an executive force and its judicial collection will be carried out by means of the procedures designated in the Judicial Code, according to the established rate system.
- Article Interruption of the services. The provider will be empowered to proceed with the interruption of the service as a consequence of delays in the payment of the amount due of the respective rate, under the circumstances established in the respective contracts, without prejudice of the corresponding payment of interests or fines.

This power can be exercised only upon industrial and commercial customers and on special services, be it public or private.

CHAPTER XIX PROHIBITIONS, INFRACTIONS, SANCTIONS AND SANCTIONING PROCEDURE

- Article Prohibitions. Every natural or artificial person; official, private or semi-state, domestic or foreign entities currently existing or to exist in the district of Panama, be it transitorily or permanently, will have the following prohibitions with regards to the non-hazardous solid wastes:
 - a. To litter or abandon solid wastes of any nature, dead animal bodies or parts of them, regardless of the origin, on public thoroughfare and areas, parks and leisure zones, lots and vacant properties, ravines, underground and superficial water bodies and courses, rainwater ditches, sewerages, rivers, beaches, mangrove swamps, open dumping sites and unauthorized sites in general, in a rural or urban area.
 - b. To dump excrements in public areas, regardless of their nature or origin, in rural or urban areas.
 - c. To dispose of household solid wastes in returnable receptacles for collective use, containers and paper bins devoted exclusively for pedestrians and located on street curbs and collective leisure spaces;
 - d. To conduct actions or omissions that hinder the cleansing of public thoroughfare and areas or the rendering of the collection and haulage service;
 - e. To create open dumping sites at unauthorized areas, be it a rural or urban zone;
 - f. To dispose of solid wastes at open dumping sites at unauthorized areas, be it a rural or urban zone;
 - g. To dispose of liquid substances, human or animal excrements, dead animal bodies or parts of them or special or hazardous in returnable receptacles for individual or collective use, public or private use containers devoted for collection;
 - h. Breeding of animals for animal consumption with solid wastes;
 - i. Burning of solid wastes in the open, except in rural and remote areas that are not provided with the collection service;
 - j. To place receptacles and bags that contain wastes at collection sites in schedules and days other than those established by the person in charge of the collection and haulage service;

		k. Any person other than those of the collection and haulage service, will not remove or extract the total or partial contents of returnable receptacles or containers of individual or collective use, once they are disposed of at the site of collection:
		 Washing and cleaning of any object on public thoroughfare and areas is prohibited when such activity originates accumulation or spreading of wastes;
		m. Segregation of the components from the wastes by the collection and haulage service crew, as well as by the sweeping and cleansing service of public thoroughfare and areas;
		 n. Collection of wastes generated within any building by the operators of the sweeping and cleansing service of public thoroughfare and areas; a. To hand over household commercial institutional industrial and sanitary
		facilities' wastes to the operators from the sweeping and cleansing service of public thoroughfare and areas;
		p. To conscientiously store wastes in a receptacle that may interact with each other, thus arising hazardous situations.
Arti	cle	Infractions and sanctions. Infractions for the customers or users will be sanctioned by the municipal authorities:
		a. With a fine of fifty Balboas (B/50.00) to five thousand balboas (B/5,000.00), depending of the severity of the breach, without prejudice of the obligation to pay for the service fraudulently used or of the damages caused. The amount of the sanction will be set by taking into account the aggravating or extenuating circumstances of the infraction, the degree of disturbance and alteration of the service and the amount of the damage or herm accounted.
		 b. The amount of the fines will go into the treasury boxes of the municipality of Panama and will be imposed regardless of other legal actions to favor third parties. Such money will be used for actions that improve ornate and cleanliness of the city.
Arti	cle	Sanctioning procedure. The procedure to be followed for the infractions committed against the cleansing regulations will be as follows:
		1. Every natural or artificial person that is summoned due to an infraction of the cleansing ordinances will have to appear before the office of the respective cleansing authority on the day and time indicated for the corresponding hearing.
		2. The summoned person will have the right to present his/her plea at the hearing.
		3. The evidence presented will be attached to the corresponding file and, in the event that said has to carried out, the cleansing authority will be able to grant up to eight (8) days, taking into consideration the number and class of evidence presented.
		4. If there were no evidence to carry out, the official will make the decision at the hearing, which will be notified in person to the person involved.
		5. In the event that tests have to be carried out, once they are over, the official will have two days to make that decision and will transmit it personally to the party involved.
		 For the purposes of reconsideration and appeal, the procedure set forth in Chapters II and III of Title XI from Law No. 38 dated July 31st, 2000.

b. Organizational Structure Adjustment

Organization structures should be adjusted to meet with needs to achieve the goal of the M/P.

We can define such organizational structure as a system, which can be described as follows:

- i) A set of elements (a General Management office, Departments and Units)
- ii) dynamically intertwined (in interaction, forming a communications network whose elements are dependent of each other)
- iii) that conduct an activity (sustainable management of solid wastes in the district of Panama)
- iv) in order to achieve an objective or purpose (to keep the district clean and promote its dwellers' well-being, contribute to health protection and preservation of the environment)
- v) by utilizing data, power and resources (human and material resources)
- vi) along with the environment surrounding the system (customers of the service, community, public and private entities)

With taking into account the above definition, a proposal of organizational structure adjustment of DIMAUD is made, aiming the following.

- To clarify responsibilities and tasks of respective departments and units.
- To outline a communications system within the entity that allows for the interaction among the administrative units.
- To increase the synergy of functions performed by all the administrative units
- To head towards efficiency through the most adequate and duly programmed means, methods and procedures, so as to ensure the optimal use of the available resources.

This section describes the proposed organization structure of DIMAUD, and responsibilities and tasks of respective departments and units.

b.1 Proposed Organization Structure of DIMAUD



The proposed organization structure of DIMAUD is presented in Figure J-17

Figure J-17: Proposed Organization Structure of DIMAUD

b.1.1 General Organization Structure

The proposed organization structure has three levels, Directive, Intermediate and Operational Level. Descriptions of respective levels are given in the following.

Directive level

It encompasses the General Manager's Office Legal Counseling Office, Coercive Jurisdiction, the Customer Attention Unit and the Executing Unit of the Master Plan.

It is known as the strategic level, since decisions are made at this level and the entity's objectives are set forth, as well as the strategies to meet them.

The above is in search of efficacy by making decisions that will maximize the environmental opportunities, will defend from menaces and will neutralize environmental restrictions and contingencies to achieve satisfactory results.

Intermediate level

It groups the chieftainships of the Administration and Finance, Operations and Commercialization Departments.

Also known as the tactic, mediator or managerial level. It ranges between the directive and the operational level, allowing internal correlations between these two levels. It oversees that the decisions made at a directive level be adequate to the actions conducted at the operational level and that the agreed strategies to meet the organizational objectives be translated into action programs.

Operational level

It encompasses all the administrative units subordinated to chieftainship offices of the corresponding departments (Accounting and Finance, Purchasing, Store room, Human Resources, Information Technology [IT], Administrative Services, Management Control) (Sweeping, Collection, ICI Collection, Transfer and Final Disposal, Maintenance) (Cadastre, Billing, Collecting).

Also known as the technical level or nucleus, it is located at internal and lower areas of the entity. Tasks and operations are carried out at this level; it includes the entity's programming and daily activities.

Its functioning follows predetermined routines and regularly continued procedures that ensure the total use of the available resources and maximize the efficiency on operations.

This level seeks the efficiency on the operations executed within the standardized, cyclical and repetitive programs, routines and procedures, so as to achieve optimal results.

b.1.2 Proposed New Administrative Units

The creation of the new administrative units is being proposed herein: Customer Attention, Management Control and the Executing Unit of the Master Plan.

Customer Attention Unit

It integrates the current functions of the Public Relations and Community Relations administrative units and creates the Marketing and Service Quality sections. It has the support of the 800ASEO service, which was upgraded and expanded to a communications system with the proper features of a Call Center.

The purpose is to achieve greater synergies among the concurring administrative units; to strengthen liaisons with the organized civil society by means of the brand new Cleansing and Ornate Committees; to promote the entity's services; to provide support to the operational

units (sweeping and collection), to achieve the positive image of the entity and to verify the quality of the services being rendered.

Management Control Unit

It has the responsibility of managing the entity's operations through the obtainment of performance indicators and their assessment versus a model with acceptable range.

It checks and evaluates the entity's productivity and competitiveness with the help of indicators; it issues statistical and managerial follow-up information to control operational costs; it generates aggregate data for the financial, operational and commercial areas.

It maintains an information flow on the performance of the selected administrative units, which in turn feedback the system and interact to achiever greater efficiencies.

Executing Unit of the Master Plan

It gathers a group of professionals and technicians of the entity who have the task of developing the activities required to implement the Master Plan within the entity. Such officials work full time and exclusively are devoted to the above purpose. It may have outside technical assistance. The Executing Unit will have the features of a private consulting firm.

b.2 Responsibilities and Tasks

This section describes responsibilities and tasks assigned to respective departments and units of DIMAUD (Refer Figure J-17).

I. General Management Office

Structure

General Manager, Legal Counseling, Coercive Jurisdiction, Customer Attention Units and the Executing of the Master Plan

Responsibility

- Runs the entity
- Appoints the mission, establishes the objectives and generates the entity's policies.
- Approves the functional and organizational structure
- Approves the budget and its execution
- Ensures the provision of the service and audits its performance
- Executes and enforces the Urban Cleansing Regulation in the municipality of Panama

Duty Assignments

To achieve DIMAUD's vision and mission:

- VISION "The city of Panama is being acknowledged again as the "golden small cup" for its ornate and cleanliness of its roads and public places, as well as for the life quality of its dwellers.
- MISSION "To promote its inhabitants' well-being through the implementation of a Sustainable Solid Waste Management that contributes to the protection of health and preservation of the environment"

Activities

- 1. To inform the entity's staff on the new Cleansing Regulation
- 2. To inform the entity's staff on the new functional and organizational structure of the entity
- 3. To define the marketing, billing and collecting policies
- 4. To analyze the entity's feasibility to set up a municipal company of urban and household cleansing.

Internal relations

The Mayor's office; with all the departments' chieftainships and with the Legal Counseling and Customer Attention Units and the Executing Unit of the Master Plan.

External Relations

With all the public entities, specially the Ministry of Health (MINSA) and the ANAM; private entities, international organizations, NGOs.

I.1. General Management OfficeUnit, LEGAL COUNSELING

Structure

Chieftainship

Responsibility

• Advises in juridical matters to the General Management Office and other administrative units to correctly interpret legal provisions.

Duty Assignments

- 1. To elaborate projects for decrees generated by the Mayor's Office
- 2. To represent and defend the entity
- 3. To review documents and issue juridical concepts
- 4. To release legal consultations and orientate in tenders
- 5. To advise on working conflict topics

Activities

1. Please refer to the activities of the Executing Unit

Internal Relations

With the General Management Office, with all the departments' chieftainships, the Customer Attention Unit and the Executing Unit. Municipality of Panama: General Secretaryship, Purchasing Department.

External Relations

MINSA, MEF, MINTRA, CGR

I.2. COERCIVE JURISDICTION UNIT, General Management Office

Structure

Two Administrative Courts (Plaza Concordia and San Francisco)

Responsibility

• To oversee the compliance with the cleansing regulations currently in force.

Duty Assignments

1. To raise awareness, cite and punish the infringers to the cleansing regulations.

Internal Relations

General Management Office and Legal Counseling

I.3. CUSTOMER ATTENTION UNIT, General Management Office

It is a new administrative unit that integrates the functions of the current Public Relations and Community Relations units, and also adds news functions associated with marketing topics and quality control of the service.

It has the objective of achieving a greater synergy among the concurrent administrative units; strengthening the relations with the organized civil society by means of the Cleansing and Ornate Committees; to merchandise the service and promote a positive image of the entity; to verify and ensure the quality of the services offered.

Structure

A chieftainship, the S.O.C.I.O (Organized Civil Society) section, the Public Relations and Marketing sections; Service Quality section. It has the support from the 800 ASEO service, which has been restructured as a Call Center and a communications system.

This unit fuses the functions of the current Public Relations and Community Relations units and adds the verification feature of the quality of the service.

Responsibility

- Establishes, enhances and maintains relations with the community and with the customers
- Promotes the management of solid wastes
- Takes care of the entity's public image
- Promotes the entity's services
- Monitors and controls the quality of the service being rendered

Duty Assignments

Chieftainship

- 1. To enforce the policy, the scope of the objectives and renders the entity's strategic plan effective in regards to customer attention
- 2. To direct and coordinate the activities from the sections
- 3. To assess the performance of the sections and the quality of the service on the basis of annual and monthly goals set out by the General Management Office
- 4. To receive feedback and adjust the activities consequently.

800ASEO Service

1. It performs as a communications unit to support the Cleansing and Ornate Committee promotion and the promotion of DIMAUD's services.

S.O.C.I.O section –(Organized Civil Society)

- 1. Promotes organization of the civil society in solid waste management issues.
- 2. Plans and carries out the educational programs and activities at teaching centers , public and private entities and communities.
- 3. Coaches residential and institutional, commercial and industrial customers in the management of solid wastes.
- 4. Designs and produces the educational and support material for the promotion of the solid waste management.

Public Relations and Marketing Section

- 1. To achieve the entity's positive public image on the basis of accomplishing its mission with the society and achieving the organization's objectives.
- 2. To handle information with mass media.
- 3. To design, organize and manage the relationships with the entity's customers.
- 4. To lay out and handle the marketing of the services being offered.

Service Quality Section

- 1. To verify the strict compliance with the service quality standards set forth in the Cleansing Code.
- 2. To be aware of the infractions on the quality of the service by the supplier of the service.
- 3. To propose the required adjustments for the operational activities, with the purpose of permanently raise the quality of the service.
- 4. To be aware of and fine public infractions to the Cleansing Code.

Activities

Chieftainship

1. To convey the customer attention policy throughout the entity by means of talks. It is very important that all the officials get a deep acquaintance of this policy, in order to control their behavior.

800ASEO service

- 1. Improvement of the customers' telephonic database (with the Executing Unit)
- 2. Arrangement of the telephone database per corregimiento, household and ICI customers (with the Executing Unit)
- 3. Receiving and recording of customer complaint calls and their submittal to the Service Quality section for their attention and follow-up.
- 4. Installation of the communications network among the Cleansing and Ornate Committees of Communal Boards, Cleansing and Ornate Committees at a neighborhood level and the DIMAUD (Customer Attention Unit)
- 5. Beginning of the marketing activities for the ICI customer services.
- 6. Beginning of public opinion surveys in accordance with the instructions by the Public Relations and Marketing sections.
- S.O.C.I.O (Organized Civil Society) section
- 1.1 Arrangements before the Corregimiento Representatives to create a Cleansing and Ornate Committee within the Communal Board structure.
- 1.2 Collaboration with the Communal Boards to organize Cleansing and Ornate Committees at a neighborhood level, urbanizations and housing complexes. The citizen security committees are a good example of what can be accomplished with communal participation.
- 1.3 Creation of the Regional Network of Cleansing and Ornate with the committees that gradually start to appear, which will use the 800ASEO service to telephonically link the DIMAUD, the Communal Boards and the Cleansing and Ornate Committees at a neighborhood level.
- 2.1 The organization of training workshops aimed at the members of the Cleansing and Ornate Committees at a neighborhood level begins. At the end of the workshop, these members will be trained to raise awareness among the population to achieve the following:
- To actively participate in the provision of the collection and sleeping services and in the maintenance of ornate and cleanliness of public areas.
- To collaborate in the cleansing operations.
- To verify and assess the quality of the service being rendered and inform their communities and the DIMAUD's Service Quality inspection on these topics.
- To encourage and control the neighbors discharging solid wastes as per the provisions of the cleansing code.
- To promote the maintenance of cleanliness in front of the properties and at public roads and areas.
- To control, avoid and report the unlawful dumping of solid and/or liquid wastes in private or public areas, water streams, ravines, vacant property, rainwater drainage or sewerage systems or other unauthorized places for such purpose.
- To pay the bills for the solid waste management services rendered, as this ensures the sustainability and quality of the service.
- To organize together in groups responsible of the activities programmed.
- To maintain a close relation with the DIMAUD's Service Quality unit.
- 3.1 Execution of the environmental education activities programmed by the Executing Unit of the Master Plan, by using the educational material donated by JICA.
- 3.2 Raising of awareness and backup to the school students in the district by attaching the "CUMPLE TU PAPEL" ("perform your task"), which is part of the solid waste minimization activities of the Master Plan.Coordinates the free provision of haulage by the DIMAUD to carry the recycled paper from schools to the receiving place.
- 4.1 Gathering, evaluation, design and reproduction of the support and educational material required for the accomplishment of its obligations.

Public Relations and Marketing section

- 1.1 Establishment of the public relations strategy, taking into consideration the enforcement of the new Urban and Household Cleansing Code, as well as the General Management's office policy and strategic guidelines.
- 2.1 Creation and maintenance of a RR.PP officials' database of public and private entities that hold relations with the DIMAUD.
- 2.2 Creation and maintenance of a mass media journalist database (radio, press and television) that cover the news related to the management of solid wastes and/or environmental issues on a routinely basis.
- 2.3 Publication of a newsletter on a regular basis with news on the DIMAUD. To be distributed among the RRPP officials (clause 2.1) and the journalists (clause 2.2). (Via e-mail and fax).Creation of a website and keep it updated. Invitation to visit the site and send opinions and suggestions on the service.
- 3.1 Relationship program with the customers by means of the 800ASEO service and the Cleansing and Ornate Committees.
- 4.1 Marketing program for ICI customers, in coordination with the Commercialization Department and the Executing Unit of the Master Plan (EUMP), on the basis of the Special Collection Service for ICI customers.
- 4.2 Conduction of the marketing program for ICI customers. Prepares progress reports of the program.
- 4.3 Training of promoters (salesmen) of the Special Collection Service.
- 4.4 Maintenance of a personalized relationship with ICI customers.
- 4.5 Designing of public opinion surveys, both at the spot as mobile ones.
- Service Quality section
- 1.1 Training to the inspectors on the enforcement of quality standards of the service contemplated in the Cleansing Code.
- 1.2 Training to the inspectors on the enforcement of infractions to the Cleansing Code

- 1.3 Beginning of service quality inspection activities of the service.
- 2.1 To be aware of and forward public complaints and inspectors reports on the infractions to the quality of the service to the corresponding administrative units, so that the alter can correct deficiencies and impose the respective sanctions. The public claims will be attended via the 800ASEO service and the Cleansing and Ornate Committees.
- 3.1 Recording of claims and/or events that breach the service quality standards; analysis and evaluation of complaints and/or events that took place on a monthly basis, so as to reach conclusions about the variants in the quality of the service and to prepare suggestions and recommendations for its correction. A monthly report on the quality of the services supplied will be prepared, to be submitted to the General Management Office.
- 4.1 The service quality inspectors will impose fines to the public on the infractions to the Cleansing Code.

Training

- 1. Procedures workshop for the operation of the 800ASEO service (800ASEO service operators)
- 2. Workshop on the Operation of Telephone Opinion Surveys (800ASEO service operators)
- 3. Participation of the organized community/Regional Network of Cleansing and Ornate (S.O.C.I.O staff and communal boards)
- 4. Seminary on the Enforcement of Service Quality Standards/Prohibitions, Infractions, Sanctions and Sanctioning Procedure (service quality inspectors, operations supervisors, cleansing and ornate committees of communal boards).
- 5. "Cumple tu papel" ("Perform your task") program workshop (S.O.C.I.O staff, Cleansing and Ornate Committees of communal boards and at a neighborhood level, school principals).
- 6. Workshop on the Marketing Program of DIMAUD services (Public Relations and Marketing personnel, Commercialization Department, Operations Department, Administration and Finance Department).

Material and Equipment

- 1. Procedure manual of the 800ASEO service (three new telephone lines, telephone accessories, furniture).
- 2. Public Opinion Surveys Manual
- 3. Guidelines on the organization of Cleansing and Ornate Committees.
- 4. Cleansing Code
- 5. Material produced and donated by JICA
- 6. Marketing Program Project

Internal Relations

With the General Management Office; Sweeping, Ordinary Collection, Special ICI Collection, Transfer and Final Disposal, Cadastre, Billing and Collecting units. Municipality of Panama: Communications Office

External Relations

Public and private entities associated to the public relations activities; mass media; Cleansing and Ornate Committees of Communal Boards and at a neighborhood level;

I.4. EXECUTING UNIT OF THE MASTER PLAN, General Management Office

This is a new administrative unit that will gather a select group of professionals and technicians of the entity, with the purpose of developing the required activities to achieve the objectives of the Master Plan.

These professionals belong to the entity's structure and will perform their work full time and exclusively dedication to this Executing Unit.

Structure

A chieftainship; Planning and Development Area, Administration and Finance area; Operations area; Commercialization Area; Customer Attention area.

An external technical assistance area is deemed as necessary to cooperate with the local professional staff to achieve the activities foreseen for the Executing Unit.

The Planning administrative unit is part of the entity's permanent structure. Functionally speaking, it is placed in the Executing Unit and will execute the routinely functions, and also will coordinate the implementation of the products stemming from the activities of the Executing Unit in the functions of the entity's diverse administrative units.

Responsibility

- To achieve the objectives of the Master Plan within the Study on Solid Waste Management Plan for Municipality of Panama in the Republic of Panama.
- To comply with the duties assigned to the Unit
- To execute the activities programmed for each one of the duties.
- To assist and support the entity's diverse administrative units in their everyday activities.

Duty Assignment

Chieftainship

- 1. Directs and coordinates the labor of the units' professionals.
- 2. Verifies that the works respond to the objectives of the Master Plan, to the tasks assigned and to the diverse activities to be developed.
- 3. Consults, coordinates and informs the top management of the entity.
- 4. Conducts the development of the works with the help of external counseling.

Technical External Assistance

- 1. Consolidates the structuring of the Executing Unit
- 2. Trains the professional staff of the Executing Unit
- 3. Advises and participates in the development of the activities assigned to the Executing Unit.

4. Advises the chieftainships of the diverse administrative units in the implementation of the products stemming from the activities of the Executing Unit.

Planning and Development

- 1. Permanently analyzes the entity's organization and the methods employed for the compliance of its functions.
- 2. Establishes the performance parameters based on coverage, productivity and effectiveness levels of the service, in order to measure its quality and obtain a favorable cost-benefit ratio.
- 3. Prepares and/or evaluates the manuals, standards, procedures, training and policy outline material.
- 4. Conducts the permanent programs on the generation of solid wastes (type, composition, generation per person, per ICI customer type, sweeping and cleaning of public roads and areas, minimization reduction reuse recycling
- 5. Programs the coverage expansion of the service, taking into account city growth and variations in the generation of solid wastes.
- 6. Determines the need to acquire collection vehicles and mobilization of staff.
- 7. Forestalls the need to acquire land to build transfer stations, sweeping stations, sanitary landfills, offices, warehouses, shops.

Activities

1) Planning and Development

- 1.1 Prepares and conducts a workshop to inform on the new Cleansing Code.
- 1.2 Prepares and conducts a workshop to inform on the entity's new functional and organizational structure.
- 1.3 Prepare conducts the workshops to train the personnel on the methodology and functional procedures, in the utilization of new instruments and tools, teamwork and information flow.
- 2.1 Establishes the general performance, operational, economic-financial, commercial, quality, cost and work accident standards, on the basis of the results obtained in the pilot project and the Study.
- 2.2 Assesses and updates the performance parameters with the Management Control administrative unit.
- 3.1 Conducts the preparation and/or evaluation of materials and design, operation and procedure standards, training material and policy guidelines, with the participation of professionals from the Executing Unit and officials from the entity's administrative units, which are described next.

FOR THE OPERATIONS AREA

- 3.1.1 Procedure to determine the generation and composition of solid wastes
- 3.1.2 Handling of the information by using the digital chart of the district, to be provided by the Comptrollership General's Office of the Republic (includes the Global Positioning System/GIS)
- 3.1.3 Data recording and processing of collection
- 3.1.4 Control and supervision in collection
- 3.1.5 Collection staff training
- 3.1.6 Time and motion survey
- 3.1.7 Control and supervision of the vehicles
- 3.1.8 Maintenance of vehicles
- 3.1.9 Design and improvement of collection and haulage routes
- 3.1.10 Foundations for laying out the special collection service for ICI customers.
- 3.1.11 Data recording and processing of manual and mechanical sweeping
- 3.1.12 Control and supervision in manual and mechanical sweeping
- 3.1.13 Staff training in manual and mechanical sweeping
- 3.1.14 Handling of the pedestrian container system
- 3.1.15 Design and improvement of manual and mechanical sweeping routes and cleaning of public areas
- 3.1.16 Landscape project of Cerro Patacón sanitary landfill, by detailing the final use of the land
- 3.1.17 Engineering project of the sanitary landfill
- 3.1.18 Entrance and unloading control at the sanitary landfill
- 3.1.19 Topographical control of the landfill progress be means of the digital chart donated by JICA
- 3.1.20 Control and supervision of the operations contracted at Cerro Patacón sanitary landfill (as per the terms of the subscribed contract)
- 3.1.21 Control in the use of covering material
- 3.1.22 Control in the extraction of materials (scavengers)
- 3.1.23 Operation and maintenance of the collection and leachate treatment (sampling and analysis of effluents of the treatment system)
- 3.1.24 Maintenance and control of the biogas management system (temperature, flow and methane concentration)
- 3.1.25 Control in the contamination of underground water through the monitoring of neighboring wells
- 3.1.26 Maintenance of infrastructure (roads, canals, water supply, collection and treatment of wastewaters, wells, power, communications, buildings, collection vehicle wash)
- 3.1.27 Organization and procedures for the security staff

FOR THE ADMINISTRATION AND FINANCE AREA

- 3.1.28 Purchasing procedure that expedites the acquisition of pieces, spare parts, materials and equipment, with the purpose of augmenting availability of the collection vehicles.
- 3.1.29 The strategic inventory of pieces, spares parts and materials (stock room) can be determined
- 3.1.30 Inventory control (with computers)
- 3.1.31 Control and updating of the entity's property (with computers)
- 3.1.32 Procedures for the assessment and depreciation of assets
- 3.1.33 Designing of an accounting system in parallel with the existing one, which will allow the recording of expenses per functional activity (administrative, financial, commercial and operational) (such as the COSEPRE)
- 3.1.34 Budgetary control
- 3.1.35 Analysis, projections and financial reports
- 3.1.36 Updating and arrangement of the staff roll per actually filled in
- 3.1.37 Updated recording of the entity's servants (personal computerized card)
- 3.1.38 Classification of positions and salary and incentive policy
- 3.1.39 Recruiting policy
- 3.1.40 Policy on the compensatory time
- 3.1.41 Training throughout the levels to enhance capabilities and skills (drivers, collection workers, sweepers, mechanics, support staff)
- 3.1.42 Occupational health program (prevention of working accidents and professional diseases)
- 3.1.43 Degree of medical, odontological and psychosocial attention at Carrasquilla medical center.
- 3.1.44 Strengthening and equipping of the above clinic
- 3.1.45 Relations and joint programs with the Seguro Social (Social Security) fund
- 3.1.46 Prevention of psychosocial risks and enhancement of self-esteem
- 3.1.47 Management and organization of the Cleansing and Ornate official day in the district of Panama, with the participation of the organized community (Cleansing and Ornate Committees)
- 3.1.48 Diagnosis, assessment, conclusions and strategy to implement an IT (information technology) system for the entity.
- 3.1.49 Maintenance manual of the entity's buildings, facilities, equipment and furniture
- 3.1.50 Procedures to receive, register, deliver, archive and send mail
- 3.1.51 Rules and control on the use of the entity's vehicles
- 3.1.52 Selection, preparation and use of performance indicators

- 3.1.53 Calculation, evaluation, recording, forwarding and feedback on the information of performance indicators
- 3.1.54 Structure and contents of the reports on the management performance
- 3.1.55 Organization and maintenance of the management information flow

FOR THE COMMERCIALIZATION AREA

- 3.1.56 Household customer database
- 3.1.57 Analysis on the willingness to pay and the affordability to pay by lower income residential customers
- 3.1.58 Analysis and structuring of the household customer rate system, as per Law No. 41 dated August 1999 (with the participation from legal Counseling)
- 3.1.59 ICI customer database
- 3.1.60 Procedures for the geographical location of ICI customers on the digitalized chart of the Comptrollership General's Office of the Republic (includes the Global Positioning System/GIS)
- 3.1.61 Procedure to determine volumetric generation per ICI customer
- 3.1.62 Minimum volume range per ICI customer to be collected by the Special Collection Service vehicles
- 3.1.63 Features of the solid wastes to be managed by the Special Collection Service to ICI customers
- 3.1.64 Analysis of the volumetric rate for ICI customers (with participation from Legal Counseling)
- 3.1.65 Contract model for the Special Collection Service for ICI customers (with participation from Legal Counseling)
- 3.1.66 Pondering of the options to bill and collect the Special Collection Service for ICI customers
- 3.1.67 Requirements to be complied by private providers of the service to obtain the Operating Permit
- 3.1.68 Coverage and amount of the Environmental Liability to render private services.
- 3.1.69 Customer database of Cerro Patacón sanitary landfill
- 3.1.70 Analysis of the final disposal rate (with participation from Legal Counseling)
- 3.1.71 Customer database of special sweeping services
- 3.1.72 Analysis of the special sweeping rate (contract for each event)
- 3.1.73 Contract model for special sweeping (with participation from Legal Counseling)
- 3.1.74 Pondering of billing and collecting activities to the IDAAN and its related costs

CUSTOMER ATTENTION AREA

3.1.75 Strategies for the development of a permanent environmental education and community participation program (teaching centers, large generators of solid wastes, cleansing and ornate committees within the district)

3.1.76 Layout of didactic material for environmental education and community participation programs, with participation from the private sector

3.1.77 Creation of the minimization policy of solid wastes, with the participation from the private sector

3.1.78 Training programs for coaches on environmental education and community participation

- 3.1.79 New strategy for the organized community participation in cleaning operations
- 3.1.80 Procedures for the conduction of opinion surveys (on-the-spot and mobile)
- 3.1.81 Training manual for the service quality inspectors

3.1.82 Procedure manual for the enforcement of fines due to public infractions

Next, the specific objectives to be accomplished at the four functional operative areas are shown, in order to meet the DIMAUD's MISSION

2) Administration and Finance Area

Purchasing

1. The activities in this department are carried out as per the new purchase procedure, and support is provided to the maintenance administrative unit to raise the vehicle availability to 85% per year

Stock room

1. The stock room has the pieces, spare parts, materials and equipment for immediate delivery to the maintenance unit

Accounting and Finance

- 1. The accounting system parallel to the official system is implemented, and it will record the expenses per functional activity: administrative, financial, commercial and operational; it will also allow the preparation of performance indicators
- 2. The financial projections document is prepared per the investment needs of the Master Plan

Human Resources

- 1. The entity's staff roll is updated according to the positions actually filled in
- 2. A computerized registry of the data of each worker and their working record sheet is available
- 3. Classification of positions is established
- 4. The salary and incentive, recruitment and compensatory time policies have been created
- 5. The entity's occupational health program has been implemented, in coordination with the General Office of Occupational Health from the Social Security Fund

- 6. The operative staff has upgraded their skills and capabilities (drivers, collection workers, sweepers, mechanics, support personnel) by means of the training programs, thus increasing their personal productivity and reducing the working accidents and professional diseases
- 7. The policy for the preventive control of working diseases, attention to working accidents, psychosocial diseases, compensation to non-worked days and expansion and improvement in the attention of Carrasquilla medical center has been created, along with the Social Security Fund
- 8. The coverage and compensations of the professional insurance policy have been negotiated and upgraded
- 9. A retirement program in advance has been negotiated for those older-age workers and with physical disabilities as a result of working accidents and diseases, along with the Social Security Fund, that do not meet the required number of contributions to achieve retirement. The emotional and physical distress undergone by the cleansing worker has been taken into consideration
- 10. The entity's worker has a better self-esteem and the organizational environment has improved
- 11. Every (day/month), the Cleansing Worker Day is celebrated in the district of Panama, with a broad participation and collaboration from the public

Information Technology (IT)

1. The entity's IT network is functioning

Management Control

- 1. The General Management Office and the selected administrative units receive the reports on the performance of the service (performance indicators)
- 2. Information on the performance flows through the IT network
- 3. The management Control evaluates the performance, prepares reports, receives comments, provides feedback to the system with the suggestions to upgrade the entity's performance
- 4. The performance indicators and their acceptable ranges appear in table T1

3) Operations Area

Ordinary Collection

- 1. Performance of the ordinary collection has been improved to the acceptable ranges suggested by the CEPIS. Routes were improved by considering the performance arising from the pilot collection project and by using the new Route Improvement Procedure Manual
- 2. The cost per ton collected and transported to Cerro Patacón sanitary landfill is found within the acceptable range suggested by the CEPIS (efficient model company)

Special Collection Service for ICI Customers

- 1. Institutional, commercial and industrial customers keep their loyalty towards the DIMAUD by being satisfied with the provision of the special collection service
- 2. Customer will declare their concord with the enforcement of the volumetric rate as they deem it as fair, since they are billed according to what they actually discharge
- 3. The use of containers has eased the enforcement of the rate and the incidence of working accidents among the special collection workers has dropped
- 4. The cost per ton collected, transported and disposed of at Cerro Patacón sanitary landfill is found within the range expected

Maintenance

- 1. The maintenance administrative unit has been upgraded and strengthened, which turns out into an annual availability of collection vehicles of 85%
- 2. The existing physical facilities have been redesigned and adapted; the preventive and corrective maintenance equipment has been repaired
- 3. The vehicles undergo daily inspections prior to their departure; they receive preventive maintenance such as lubrication, greasing of the framework, greasing of the compaction device and checkup of operational controls (engine, transmission, brakes, electrical and hydraulic equipment), in accordance with the manufacturer's manual
- 4. The personnel improved their expertise and skills after receiving the training courses
- 5. The maintenance, collection and stock room units work in a coordinated and harmonic manner

Manual and mechanical sweeping

- 1. The manual and mechanical sweeping areas and routes have been outlined
- 2. The manual sweeping performance has been improved to the acceptable ranges suggested by the CEPIS.
- 3. The cost per kilometer swept is found within the acceptable range by the CEPIS
- 4. The mechanical sweeping is working at selected avenues
- 5. The amount of solid wastes swept per kilometer has dropped with the installation of pedestrian bins and at bus stops (urban furniture), as well as with the collaboration and education of passers-by
- 6. The Social Security Fund and the DIMAUD have agreed to create a procedure to allow retirement in advance of the older-aged and physically disabled workers

Transfer

This activity will be subject to the outcome of the corresponding feasibility study.

Final disposal

1. The entity records the entire information regarding the entrance of vehicles and the type and amount of wastes to be unloaded. This information will be transmitted via the entity's IT network

- 2. Only the solid wastes contemplated in the Cleansing Code will be received and disposed of
- 3. The operations will be carried out in accordance with the engineering design derived from the final use of the land, once it has been landfilled
- 4. The National Environment Authority has negotiated with the Municipality of Panama the use of a hill for the extraction of covering material. The municipality of Panama has presented the landscape project and the works program to create an ecological park at the landfilled property, which will also be incorporated to the Camino de Cruces park
- 5. The dumping of effluents from the leachate treatment facility meets regulations currently in force. During summer, such effluents are utilized for sprinkling irrigation of the ecological park, and re-injected again in the cells to unleash biogas production
- 6. The biogas treatment facility is generating 6 MW.
- 7. Stage I of the sanitary landfill has been reconditioned and is being visited by the public
- 8. No scavengers present at the sanitary landfill after the implementation of the social action program in cooperation with other governmental entities, private activities and NGOs
- 9. The new contract for the operation of Cerro Patacón sanitary landfill will last for six years. The contractor will strictly meet the terms of reference

4) Commercialization area

- 1. An updated and complete customer database is available of both residential and ICI customers, as well as of customers of Cerro Patacón sanitary landfill and special sweeping
- 2. ICI customers have been geographically located on the entity's digitalized chart
- 3. The Municipal Council approved the new rate system as set forth in the Cleansing Code and in Law dated August 1999. The cleansing rate for household customers responds to justice and fairness criteria. The rates for ICI customers is volumetric-wise. The rate for final disposal at Cerro Patacón sanitary landfill is based on the weight and type of solid wastes discharged.
- 4. The Special Collection Service has a particular acceptance by ICI customers (refer to Annex 2)
- 5. ICI customers are directly billed and collected by the Special Collection Service. Billing and collecting for residential customers will be conducted via the IDAAN
- 6. Private suppliers of ICI collection services have the operation permit issued by the Municipality, according to the Cleansing Code
- 7. Billing and collecting increases significantly and is associated with a better quality of the services provided and to customer attention

5) Customer Attention area

- 1. The 800ASEO service (Call Center) has its new office, with six telephone lines with the capacity to place make 400 daily calls to customers. It works as a support for several activities: attention to claims, marketing of services, communications linkage with the Cleansing and Ornate Committees, encouragement of community participation in cleaning operations, upgrading of the customers' database, opinion surveys, both on-the-spot and mobile.
- 2. A Cleansing and Ornate Committee at a Communal Board level has been organized within all the corregimientos. The Regional Network of Cleansing and Ornate has also been organized and is linked by means of the communications system of the 800ASEO service
- 3. The S.O.C.I.O administrative unit (community relations) participates in the duty of minimizing wastes. It supports the "Cumple tu papel"("perform your task") newspaper recycling program, promoting participation from teaching centers, both public and private, by means of consciousness talks with the help of the material provided by JICA. Likewise, it coordinates the collection of paper that is transported fro free by the DIMAUD. Most of the district's teaching centers are participating in this program
- 4. The marketing program for the services being provided by the DIMAUD is being developed along with the Commercialization Department, specially towards ICI customers
- 5. Public mass media, public entities and private associations, higher teaching centers, professional colleges and other entities that shape opinions receive DIMAUD's newsletter and press releases for special events. The entity's webpage is visited by an important number of cybernauts, and by means of e-mails public opinions on the provision of the service and important suggestions to improve it are received
- 6. The duly trained service quality inspectors check on the quality of the service supplied by the entity in accordance with the provisions of the Cleansing Code, and inform the Customer Attention unit on the deficiencies found to act accordingly. Public infractions are sanctioned as per the Cleansing Code by following the preset procedures

Training

The staff of the Executing Unit is trained by means of External Technical Assistance

Material and equipment

1. Six (6) computers

Internal Relations

With the General Management Office; with all the entity's department chieftainships and administrative unitsMunicipality of Panama: Organization and Methods Unit

External Relations

MINSA, MIVI, MEF, MEDUC, ANAM, ARI, ACP, CGP

II. DEPARTMENT OF ADMINISTRATION AND FINANCE

Structure

Chieftainship; Accounting and Finance, Human Resources, IT, Administrative Systems and Management Control Units

Responsibilities

- Provision of human, material and financial resources
- Recording, handling and control of accounting and financial operations
- Human Resources management
- Operation and maintenance of the IT network
- Control over the use of the entity's goods
- Conservation of physical infrastructure
- Permanent surveillance over goods and property and protection of the staff
- Management Control of the entity's operations

Duty Assignments

Conduct the department's management

Internal Relations

With the General Management Office; all the departments' chieftainships, Customer Attention units and the Executing Unit

External Relations

MEF, MINGOB, CGR, Social Security Fund

II.1 ACCOUNTING AND FINANCE UNIT, Department of Administration and Finance

Structure

Chieftainship, Budget, Accounting, Finance and State Property sections

Responsibility

• To prepare, record and control the entity's financial, accounting and patrimonial activities

Duty Assignment

Chieftainship

- 1. To lead and coordinate the sections' activities
- 2. To prepare the draft budget and submit it to the General Management Office
- 3. To verify that the expenses applications have a budgetary content
- 4. To control the official accounting system for cost accounting
- 5. To control the cash flow

- 6. To review the financial statement reports
- 7. To supervise the status of state property
- 8. To prepare the accounting and financial documentation for fiscal control purposes

Budget section

1. Budget control (revenues, expenses and investments)

Accounting section

- 1. Accounting registry as per the procedures and practices set forth for local governments
- 2. An accounting system in parallel to the official system that records the expenditures per functional activity (cost accounting), in order to facilitate the preparation of performance indicators

Finance section

- 1. Report of financial statements
- 2. Financial forecasts as per the investment needs contained in the Master Plan
- 3. Projected cash flows

State Property section

- 1. Updates inventory of the entity's state property
- 2. Control and updating of the entity's goods; re-appraisal and depreciation of assets; request of elimination of property before the MEF; flow of incoming and outgoing goods, in coordination with the stock room section

Training

1. Workshop on the Parallel Accounting System Associated with Cost Accounting (Accounting and Budget headcount)

Material and equipment

1. COSEPRE system

Internal Relations

With all the entity's administrative units, Municipality of Panama: Administrative Management Office, Financial Management Office

External Relations

MEF, CGR

II.2. PURCHASING UNIT, Department of Administration and Finance

Structure

Chieftainship

Responsibility

• Timely acquisition of goods and services

Duty Assignment

Chieftainship

- 1. Specifications in coordination with the requesting administrative unit,, and found availability with the budget section
- 2. Request and evaluation of quotations
- 3. Control of purchase orders
- 4. To program and hold public acts

Training

1. Workshop on the Purchasing and Stock Room Procedure (purchasing, stock room, sweeping, collection and maintenance staff)

Material and equipment

1. Purchasing and stock room manual

Internal Relations

With all the entity's administrative unitsMunicipality of Panama: Administrative Management Office, Financial Management Office

External Relations

Comptrollership General's Office of the Republic (CGR), supplying enterprises

II.3. STORE ROOM UNIT, Department of Administration and Finance

Structure

Chieftainship

Responsibility

• To receive, store and provide materials, tools and spare parts

Duty Assignments

Chieftainship

- 1. Prepares the annual needs program in coordination with the entity's chieftainships of the administrative units
- 2. Reception and storage of goods acquired
- 3. Stock control and timely notice to the purchasing department to keep strategic stock

Training

1. Workshop on the Purchasing and Stock Room Procedure (Purchasing, Stock Room, Sweeping, Collection and Maintenance staff

Material and equipment

1. Purchasing and Stock Room manual

Internal Relations

With all the entity's administrative unitsMunicipality of Panama: Administrative Management Office, Financial Management Office

External Relations

MEF, Comptrollership General's Office of the Republic (CGR)

II.4. HUMAN RESOURCES UNIT, Department of Administration and Finance

Structure

Chieftainship, Operational Training, Occupational Health, Personnel Actions, Staff Roll and Social Work sections

Responsibility

• Human Resources management

Duty Assinments

Chieftainship

- 1. To lead and coordinate he sections' activities
- 2. To improve the workers' skills, capabilities and knowledge
- 3. To control the incidence of working accidents and professional diseases
- 4. To follow up the occupational health program
- 5. To control and approve the rotation of the staff's actions
- 6. To verify and approve the salary payment lists
- 7. To ensure the workers' social and working welfare and the organization's environment
- 8. To oversee the operations staff training and their relations and behavior with the customers and public in general

Operational Training Section

- 1. Training throughout the levels to improve the skills and capabilities
- 2. Upgrading of middle management and chieftainship knowledge
- 3. Training of the operational staff in their relations and behavior with the customers and public in general

Occupational Health section

- 1. To provide an integral attention in preventive and curative health, a hygienic and safe working environment to protect the worker
- 2. To develop occupational health programs; to oversee medical attention; to provide prevention programs; attention to laboratories and medication; control and elimination of working and psychosocial risks

Personnel Actions section

- 1. To formalize the workers' actions and keep registries updated
- 2. Formalities for appointments, holidays, permits, layoffs, assistance, licenses, punctuality, absences, contracts, professional risks, sickness, work letters, compensatory time, resignation

Staff Roll section

- 1. To prepare the salary payment lists
- 2. Salary payment lists, recording of checks reimbursable to National Treasury, control of wages, claims, discount for unjustified absences and tardiness, sworn statements of the number of workers

Social Work section

- 1. To contribute to social and working welfare of the workers by attending their problems and needs
- 2. To plan, supervise and assess the social assistance programs; attend social and economic needs at an individual, group, family and therapeutic level; preventive, educational and recreational psychosocial programs; guidance for alimony, family planning and ceasing of work; to encourage attitude, behavior and mentality changes and self-esteem enhancement; elaborate diagnosis; enhance social programs

Training

- 1. Operational training workshops for the workers (workers in general)
- 2. Occupational health course (DIMAUD/Social Security) (occupational health personnel and middle management and chieftainship staff of the Operations Department)
- 3. Occupational health/Social Security workshops (workers in general)
- 4. Workshop on Staff Registry (Personnel Actions and Staff Roll headcount)
- 5. Workshop on the Classification of Positions and Normalization of the Staff Roll (Department chieftainships and unit chiefs)
- 6. Workshops on Joint Actions between the DIMAUD and Social Security (Department chieftainships, unit chiefs and Social Security personnel)
- 7. Workshop on the Attention to Psychosocial Problems and Self-Esteem Enhancement (Social Work and Social Security headcount)

Material and equipment

- 1. Two (2) computers
- 2. Coaching handbook for Manual and Mechanical Sweeping Personnel

- 3. Training Manual of the Ordinary and Special Collection personnel
- 4. Training Manual of the Transfer and Final Disposal personnel
- 5. Training Manual of the Maintenance Staff

Internal Relations

With all the entity's administrative units, Municipality of Panama: Administrative Management Office, Social Management Office

External Relations

MINSA, MINTRA, CGR, Social Security Fund, INAFORH, APLAFA, ANSEC

II.5. INFORMATION TECHNOLOGY UNIT, Department of Administration and Finance

Structure

Chieftainship

Responsibility

Operation and maintenance of the IT network

Duty Assignments

Chieftainship

- 1. To oversee the safety and functioning of automated information
- 2. To plan the needs; provide counseling; handle information; provide coaching

Training

- 1. Workshop on the Diagnosis, Evaluation and Strategies to Implement an IT System (Department chiefs, unit chieftainships)
- 2. Network management course (IT Systems and Cadastre staff)
- 3. Database Management Course (IT Systems, Cadastre, Human Resources, Collection, Sweeping, Transfer and Final Disposal headcount)
- 4. Geographical Information Systems Course (IT Systems and Cadastre personnel)

Material and equipment

- 1. Document on the diagnosis, evaluation and strategies to implement an IT System
- 2. Manual of the Course on Network Management
- 3. Database Course Manual
- 4. Geographical Information Systems Manual

Internal Relations

With all the administrative units (network functioning, technical assistance), Municipality of Panama: Information System

II.6. ADMINISTRATIVE SERVICES, Department of Administration and Finance

Structure

Chieftainship, Security and general Services sections

Responsibility

• Security, administrative support and maintenance in general

Duty Assignments

Chieftainship

- 1. To lead the sections' activities
- 2. To verify that the security system ensures the personal protection of the workers and the entity's property
- 3. To ensure that the unit's support services ease the entity's administrative works
- 4. To maintain the facilities in their best functioning capacity
- 5. To control and approve the use of support vehicles of the entity

Security section

- 1. Permanent surveillance of the entity's goods and property
- 2. Protection to the staff

General Services section

- 1. Archive and mail: receive, record, distribute, deliver and maintain mail filing and documentation and reproduction of documents
- 2. Maintenance of infrastructure: preventive maintenance and repairs to the facilities, furniture and equipment; cleansing and cleanliness
- 3. Control in the use of the entity's support vehicles (with the exception of collection vehicles)

Training

- 1. workshop on Personnel Safety and the Entity's Goods (Department chiefs and unit chieftainships)
- 2. Workshop on the maintenance to Facilities (General Services personnel)

Material and equipment

- 1. DIMAUD's Security System Manual
- 2. Maintenance Manual of the Facilities

Internal Relations

In Services with all the administrative units; In Safety with the sweeping, collection, transfer and final disposal units; and with the State Property section, Municipality of Panama: Services Management Office

External Relations

With public service companies (IDAAN, EDEMET-EDECHI, CABLE & WIRELESS). MINGOB, National Police, Fire Department.

II.7. MANAGEMENT CONTROL UNIT, Department of Administration and Finance

This is a new administrative unit with the purpose of controlling and assessing the entity's management and performance

Structure

Chieftainship; Performance Indicators and Management Evaluation sections, and Information Flow

Responsibility

• To control and evaluate the entity's operations

Duty Assignments

Chieftainship

- 1. To lead and coordinate the sections' activities
- 2. To verify the quality of the information submitted by the administrative units
- 3. To supervise the obtaining of performance indicators
- 4. To lead the management assessment
- 5. To ensure the information flow

Performance Indicators and Management Evaluation

- 1. To receive the basic information to obtain performance indicators
- 2. To calculate, assess and record the indicator results on a daily basis
- 3. To prepare and present the status reports at a monthly meeting of top managerial levels
- 4. To adjust the performance indicators in coordination with the chieftainships of the administrative units

Information flow

- 1. To distribute the indicator information among the hierarchical levels of the selected administrative units
- 2. To gather the opinion and suggestions of hierarchical levels
- 3. To provide feedback for the managerial information system

Training

- 1. Workshop on the management of Performance Indicators (Department chiefs, units chieftainships, other staff associated to preparing the performance information, IT Systems staff)
- 2. Workshop on the Maintenance of the Information Flow (Management Control and IT Systems personnel)

Material and equipment

1. Performance Indicator Management Handbook

Internal Relations

With the selected administrative units

III. OPERATIONS DEPARTMENT

Structure

This is a new department that integrates the provision of sweeping, ordinary collection, special ICI collection, transfer, final disposal and maintenance operational services.

It creates an enhanced synergy of the operations, improves the integral quality of cleanliness, cuts down total costs and creates a positive organizational environment.

Chieftainship: Must be necessarily in charge of an Engineering professor with experience in the conduction of solid waste management services.

Sweeping and cleaning, ordinary collection, special ICI collection, transfer and final disposal and maintenance units

Responsibility

• To provide the integrated services being rendered by the DIMAUD to its customers and the community in the district of Panama

Duty Assignment

Chieftainship

- 1. To lead the provision of the services with the procedures of an efficient model company: sweeping and cleaning of public roads and areas, ordinary collection, special ICI collection, transfer and final disposal and maintenance
- 2. To maintain coordination and completeness among the department units for the provision of the services
- 3. To verify and assess the unit's performance and prepare the indicators
- 4. To control quality and cost of the services provided
- 5. To make annual projections on the human resources needs (drivers, collection workers, mechanics, supervisors) and materials (vehicles, pieces and spare parts, fuel, lubricants, tires, etc.) and inform of these on time to the Administration and Finance Department
- 6. To coordinate the coverage expansion and enhancement and the quality of the services along with the Planning and Development Unit
- 7. To ensure the compliance with the entity's objectives and goals

Training

- 1. Course on the Management of Solid Wastes (professional and technical staff of the Operations Department)
- 2. Workshop on the Integration and Completeness of the Sweeping, Collection, Transfer, Final Disposal and Maintenance Services (professional and technical staff of the Operations Department)

- 3. Workshop on Costs Estimates of the Operational Services Supplied (professional and technical staff of the Operations Department and Administration and Finance Department)
- 4. Workshop on the Quality of the Service (professional and technical staff of the Operations, Administration and Finance and Commercialization Departments)

Material and equipment

- 1. Course Manual on Solid Waste Management
- 2. Cost Estimate Manual of the Operational Services Supplied

Internal Relations

With the General Management Office; department chieftainships, Municipality of Panama: General Secretaryship

External Relations

MINSA, ANAM, MOP

III.1. SWEEPING UNIT, Operations Department

Structure

Chieftainship; Sweeping and Manual Cleaning sections, morning and night shift, Mechanical Sweeping, and Special Cleaning Services Hired

Responsibility

• To maintain cleanliness of public roads and areas

Duty Assignment

Chieftainship

- 1. To lead the provision of the sweeping and manual cleaning services in morning and night shifts, mechanical sweeping and special cleaning services hired
- 2. To maintain completeness among the operations of the unit sections
- 3. To coordinate the installation of pedestrian bins regarded within the Urban Furniture program
- 4. To maintain operational coordination with the Ordinary Collection, Special ICI Collection, Stock Room and Customer Attention units
- 5. To control the performance of the operations in accordance with the preset indicators
- 6. To verify the quality of the service

Manual Sweeping section, morning and night shift

- 1. To verify that the personnel has their uniforms, working material (bags, brooms), tools, protection equipment and their working cart in working conditions
- 2. To conduct cleaning and sweeping of public roads and areas assigned to them
- 2.1 Morning shift sweeping section
- 2.2 Night shift sweeping section

3. Supervision of duties

Mechanical sweeping section

- 1. To verify that the personnel is furnished with their corresponding uniforms, material (bags, brooms), tools, special protection equipment and their cart in working conditions
- 2. To conduct mechanical sweeping on the selected avenues
- 3. Supervision of the duties
- 4. To ensure availability of mechanical sweepers in coordination with the Maintenance Unit

Special Cleaning Services Hired section

1. To attend the cleaning services hired with the entity for special events and public performances, as well as private parking areas

Training

- 1. Course on the Design and Improvement of Manual and Mechanical Sweeping Routes (professional and technical sweeping staff)
- 2. Workshop on the Enhancement of Manual and Mechanical Sweeping Service (professional and technical sweeping headcount)

Material and equipment

1. Design and Improvement of Manual and Mechanical Sweeping Routes Handbook

Internal Relations

Collection units, Human Resources

III.2. COLLECTION UNIT, Operations Department

Structure

Chieftainship; Zone A Morning and Night shift Ordinary Collection, Zone B Morning and Night shift Ordinary Collection, Special Household Service, Immediate Attention and Cleaning Operations

Responsibility

• Collection and haulage of solid wastes

Duty Assignments

Chieftainship

- 1. To lead the provision of morning and night ordinary collection, immediate attention to the complaints reported by means of the 800ASEO service, as well as to provide support to the cleaning operations
- 2. To maintain completeness among the unit's section operations
- 3. To maintain operational coordination with the Sweeping and Cleaning, Special ICI Collection, Transfer and Final Disposal and Customer Attention units
- 4. To control the operations' performance in accordance with the preset indicators

5. To verify the quality of the service

Zone A Morning and Night shift Ordinary Collection section

- 1. To provide the ordinary morning and night shift collection service at the following corregimientos: Ancón, Bethania, Curundú, Chorrillo, San Felipe, Bella Vista, Calidonia and Santa Ana
- 2. Supervision of the duties
- 3. To ensure the availability of the collection vehicles in coordination with the Maintenance Unit and the cleaning tools
- 4. To verify that the personnel has their uniforms, the required protection material and equipment and the appropriate presence

Zone B Morning and Night shift Ordinary Collection section

- 1. To provide the ordinary morning and night shift collection service at the following corregimientos: Juan Díaz, Pedregal, Tocúmen, Pacora, San Martín, Las Cumbres, Chilibre, Río Abajo, Pueblo Nuevo, San Francisco and Parque Lefevre
- 2. Supervision of the duties
- 3. To ensure the availability of the collection vehicles in coordination with the Maintenance Unit and the cleaning tools
- 4. To verify that the personnel has their uniforms, the required protection material and equipment and the appropriate presence

Special Household Service section

- 1. To provide the residential customers with a special service required by the management of solid wastes not being contemplated in the ordinary service, as set forth in the Cleansing Code
- 2. To forward the data requesting the special household service to the Commercialization Department for the respective quotation
- 3. The service will be rendered after receiving the order from the Commercialization Department
- 4. To supervise the duties and the quality of the service being rendered
- 5. To inform the Commercialization Department of the provision of the service

Immediate Attention section

- 1. To attend and solve the claims on deficiencies of the collection service reported via the 800ASEO service
- 2. To coordinate its operational activities with those of the ordinary collection sections
- 3. To maintain a close contact with the 800ASEO service

Cleaning Operations section

- 1. To coordinate the programmed cleaning operations with the Customer Attention unit (S.O.C.I.O section), in order to achieve community participation
- 2. To support and participate in the cleaning operations, in coordination with the Ordinary Collection, Sweeping and Cleaning, Transfer and Final Disposal units

Training

- 1. Course on Design and Improvement of Ordinary and Special Collection Routes
- 2. Workshop on the Improvement of the Collection Service (professional and technical Collection personnel)

Material and equipment

1. Course Handbook on Design and Improvement of Ordinary and Special Collection Routes

Internal Relations

Sweeping, Special ICI Collection, Transfer and Final Disposal, Maintenance, Human Resources and Cadastre units

III.3. Institutional Commercial Industry (ICI) COLLECTION UNIT, Operation Department

Structure

Chieftainship; Collection and Supervision sections

Responsibility

Special collection to ICI customers and haulage

Duty Assignments

Chieftainship

- 1. To lead the provision of the special ICI collection service
- 2. To maintain coordination with Sweeping and Cleaning, Ordinary Collection, Transfer and Final Disposal, Customer Attention units and with the Commercialization Department
- 3. To effectively coordinate with the Generation Estimate section of the Cadastre unit from the Commercialization Department
- 4. To control the operations' performance in accordance with the preset indicators
- 5. To verify the quality of the service

Collection

- 1. To render the special collection to institutional, commercial and industrial customers (ICI)
- 2. To ensure the availability of the collection vehicles in coordination with the Maintenance unit, as well as the cleaning tools
- 3. To ensure the availability of containers for these customers in coordination with the Stock Room unit and the Commercialization Department

4. To verify that the staff is furnished with their uniforms, the required protection material and equipment and the appropriate presence

Supervision

- 1. To verify that the programmed routes have been attended and that the service has been effectively provided to every customer of each route
- 2. To verify the quality of the service
- 3. To attend complaints, suggestions and concerns of the customers while en route
- 4. To present a daily report to the unit chieftainship

Training

1. Workshop on the Design of Special ICI Collection Routes (professional and technical staff of this unit and of the Ordinary Collection unit)

Material and equipment

1. Two (2) computers

Internal Relations

With the Sweeping, Ordinary Collection, Transfer and Final Disposal, Maintenance, Human Resources and Cadastre units

III.4. TRANSFER AND FINAL DISPOSAL UNIT, Operations Department

Structure

Chieftainship; Transfer and Final Disposal sections

Responsibility

To run the transfer station(s) and Cerro Patacón sanitary landfill

Duty Assignments

Chieftainship

- 1. To lead the provision of the transfer and final disposal services
- 2. To maintain coordination with unit's section operations
- 3. To maintain coordination with the Ordinary Collection, Special ICI Collection and Maintenance units
- 4. To control the operations' performance in accordance with preset indicators
- 5. To supervise the strict compliance with the operating contract of the sanitary landfill
- 6. To comply with the engineering project activities of the sanitary landfill
- 7. To verify the quality of the services

Transfer section

- 1. To render the transfer service of solid wastes to Cerro Patacón sanitary landfill
- 2. To maintain operational coordination with the Ordinary Collection, Special ICI Collection and Final Disposal units
- 3. To control the operations' performance in accordance with preset indicators
- 4. To verify the quality of the service

Final Disposal section

- 1. To provide the final disposal service at Cerro Patacón sanitary landfill in accordance with the engineering project and with the preset technical procedures and standards
- 2. To supervise the contractor's operational performance, so that they adjust to what has been agreed in the contract and in the technical specifications

Training

- 1. Workshop on the Location of Transfer Stations (transfer and final disposal staff)
- 2. Workshop on the Management of Cerro Patacón Sanitary Landfill (transfer and final disposal, ordinary collection and Special ICI collection personnel)

Material and equipment

- 1. Draft Landscape Design of Cerro Patacón Sanitary Landfill
- 2. Engineering Project of Cerro Patacón Sanitary Landfill
- 3. Procedure Manual for Solid Waste Control Entering Cerro Patacón Sanitary Landfill, as per the Cleansing Code
- 4. Procedure Manual for the Operation of Cerro Patacón Sanitary Landfill

Internal Relations

Ordinary Collection, Special ICI Collection, Maintenance, Human Resources, Cadastre, Billing and Collecting units

III.5. MAINTENANCE UNIT, Operations Department

Structure

Chieftainship; Preventive Maintenance, Automobile Mechanics and Other Maintenance Services sections

Responsibility

• To ensure the availability of collection vehicles and backup equipment

Duty Assignments

Chieftainship

- 1. To program the works as per the needs of the Ordinary Collection and Special ICI Collection units
- 2. To lead and control the duties scheduled

- 3. To maintain operational coordination with the Stock Room, Ordinary Collection, Special ICI Collection, Sweeping and Cleaning and Transfer and Final Disposal units
- 4. To control the use of the equipment, materials, pieces, spare parts, tires, fuel and lubricants
- 5. To verify the quality of the service

Preventive Maintenance section

- 1. To provide preventive maintenance to vehicles, according to the scheduled timetable recommended by the manufacturer and to the established procedures (lubrication, greasing, lights, brakes, steering gear, suspension, tires, electrical system, hydraulic system)
- 2. To conserve vehicles in the best working and visual conditions
- 3. To request and make sure that all the means to comply with the duties are available on time

Automobile Mechanics section

- 1. To verify the damages and breakdowns reported by the drivers
- 2. To repair mechanical failures
- 3. To request and make sure that all the means to comply with the duties are available on time

Other Maintenance Services section

- 1. To maintain vehicles in optimal working conditions
- 2. To make pieces with a milling device, rectifications, welding, electricity jobs, regrooving and change of tires, change of batteries, greasing, tinsmith and paint
- 3. To build containers for the storage of solid wastes and other elements for collection, sweeping and cleaning

Training

1. Maintenance Course on Collection Vehicles (Maintenance, Ordinary Collection and Special ICI Collection staff, with participation from technicians of the vehicle selling company)

Material and equipment

1. Course Handbook on the Maintenance of Collection Vehicles

Internal Relations

With Sweeping, Ordinary Collection, Social ICI Collection, Transfer and Final Disposal, Human Resources, Purchasing and Stock Room units

IV. COMMERCIALIZATION DEPARTMENT

Structure

Chieftainship; Cadastre, Billing and Collecting sections

Responsibility

• To ensure that the revenues for the services rendered are collected

Duty Assignments

Chieftainship

- 1. To lead and control the duties of the units
- 2. To define the marketing, billing and collecting policies along with the General Management Office
- 3. To keep the customer database updated in coordination with the IDAAN
- 4. To conduct billing according to the official rates and to the actual services provided
- 5. To collect the bills issued and delivered
- 6. To keep operational coordination with Department of Administration and Finance (Accounting and Finance and Management Control units), Operations Department (Sweeping and Cleaning, Ordinary Collection, Special ICI Collection, Transfer and Final Disposal units) and the Customer Attention Unit (Public Relations and Marketing and Service Quality sections and the 800ASEO service)
- 7. To verify the quality of the service

Training

1. Workshop on the Definition of Marketing, Billing and Collecting Policies (personnel from the Commercialization, Administration and Finance and Operations Department and Customer Attention unit)

Material and equipment

1. Marketing, Billing and Collecting Policies Document

Internal Relations

With the General Management Office; department chieftainships

External Relations

MEF, MINSA, ANAM, CGR, IDAAN, private company associationsAll household and ICI customers

IV.1. CADASTRE UNIT, Commercialization Department

Structure

Chieftainship; Customer Database and Generation Estimate sections

Responsibility

• To keep the customers' database updated

Duty Assignment

Chieftainship

- 1. To lead the unit duties
- 2. To verify that the customer data are updated
- 3. To forward the information on the variations found at the customers' database to the IDAAN
- 4. To verify that the classification of residential customers and their respective billing are adequate
- 5. To verify that the volume of solid wastes from ICI customers is correct
- 6. To keep operational coordination with the Special ICI Collection Unit

Customer Database section

1. To keep the customers' database updated

Generation Estimate section

- 1. To classify household costumer according to current rate system in force
- 2. To calculate the volume generated per each ICI customer through a direct evaluation, in order to choose the type of container
- 3. To provide assistance to customers on generation issues
- 4. To forward this information to the Billing unit

Internal Relations

Ordinary Collection, Special ICI Collection, Transfer and Final Disposal, Municipality of Panama: Administrative Management Office (Patents)

External Relations

MINSA, MEF, CGR.All household and ICI customers

IV.2. BILLING UNIT, Commercialization Department

Structure

Chieftainship; Billing section

Responsibility

• To issue and deliver the bills for the services provided

Duties

Chieftainship

- 1. To lead the section's job
- 2. To verify that the billing process is conducted as per the rates currently in force and to the actual services rendered
- 3. To send the billing to the IDAAN on a monthly basis

- 4. To make sure that the billing process is conducted expeditiously and on time to the customer
- 5. To verify the quality of the service

Billing section

- 1. To issue the bills for the following services on time:
- 1.1 Ordinary collection service
- 1.2 Special residential service
- 1.3 Special ICI collection service
- 1.4 Sweeping and cleaning by means of a contract
- 1.5 Transfer service
- 1.6 Final disposal service
- 2. To deliver the bills of the services rendered on time

Internal Relations

Sweeping, Ordinary Collection, Special ICI Collection, Transfer and Final Disposal units, Municipality of Panama: Financial Management Office

External Relations

All household, eventual and ICI customers

IV.3. COLLECTING UNIT, Commercialization Department

Structure

Chieftainship; Collecting and Claims sections

Responsibilities

• To charge the customers for the services rendered

Duty Assignments

Chieftainship

- 1. The lead the sections' job
- 2. To verify that collecting is carried out within reasonable timetables
- 3. To control the results of the collecting endowed to third parties with the IDAAN
- 4. To control the credit statements
- 5. To maintain registries of delay in payment
- 6. To follow up the claim process
- 7. To oversee the quality of the service

Collecting section

- 1. To carry out the collecting process for the services provided
- 2. Top verify the results of the collecting process along with the IDAAN

- 3. To prepare credit statements
- 4. To keep registries of delay in payment updated

Claims section

- 1. To attend customer complaints on the billing process
- 2. To conduct investigations and report the outcome to the customer

Internal Relations

Transfer and Final Disposal Unit, Municipality of Panama: Financial Management Office

External Relations

All household, eventual, ICI customers

c. Human Resource Development

During the Study, various human resource developments have been carried out through joint formulation of the M/P, implementation of the Pilot Projects, periodical counterpart meetings, technical transfer seminars, etc.

Besides the activities above, the trainings necessary for each department and unit are provided in the previous section through consultation with the Panamanian side.

d. Management Development

The entity's management is controlled and evaluated through the use of performance indicators. The purpose is to have a decision-making tool that allows for a continuous improvement. These indicators are obtained by consolidating the information derived from the execution of activities of selected units and the costs incurred. Those are categorized as follows.

- Indicator flow of operational indicators
- Information flow of financial indicators
- Information flow of cost indicators
- Information flow of accident indicators while at work
- Information flow of commercial indicators
- Information flow of service quality indicators

The procedure to be utilized is the following:

- 1. The operational units selected and the Accounting and Finance unit (expenses) prepare the information on the corresponding performance and such is sent to the Management Control Unit (Input Flow)
- 2. The Management Control Unit consolidates this data and generates the performance indicators and assesses them versus the preset recommendable ranges and elaborates the report.
- 3. The Management Control Unit forwards the performance indicators to the selected units (Output Flow)
- 4. This information system feedbacks with the remarks and suggestions from the units.

The Input and Output information flow in the organic structure appears in Figure J-18 and Figure J-19.



Figure J-18: Information Flow in DIMAUD (Input Flow)



Figure J-19: Information Flow in DIMAUD (Output Flow)

e. Financial Development

In order to carry out sound and sustainable operation of SWM, securing an adequate financial base and controlling income and expenditure are crucial. This issue is described in the section of "Financial System."

J.2.5 Financial and Accounting System

In order to implement sound and sustainable operation of SWM, two issues from a financial view point are important and those should be always kept in mind at the top management level and sections concerned. Those two issues are i) financial source securing and budgeting (finance) and ii) to control flow of income and expenditure (accounting).

a. Finance

Budgeting is a kind of results of decision-making. Therefore, this section focuses on measures to secure financial sources. The M/P recommends the following.

- Special Collection Service for Institution, Commerce and Industry (ICI)
- Waste Collection Efficiency Improvement
- Fee Collection Improvement by the Commercial Department
- Simplifying ICI Tariff

a.1 Special Collection Service for Institution, Commerce and Industry (ICI)

Background

The economic activities which are being conducted in the Panama District involve 1/3 of the Economically Active Population (EAP) and represent 60% of the Gross Domestic Product (GDP) in the country. This situation leads to the generation of large quantities of solid wastes of all kind.

In addition to the population who are permanent residents, thousand of persons come in to the District to take care of their occupations or do diverse types of errands. Their activities contribute to increase the waste generation originated by institutions, commerce, and industries (ICI).

Currently, an average of 965 ton/day are being collected from the Panama District. Then, 515 ton/day is considered as ICIs' waste out of the 965 ton/day. Table J-41 and Table J-42 presents the current waste amount in transport actors.

						unit: Tons/day	
		Direct Transport					
Туре	DIMAUD	Junta	Institution	Private	Private	Total	% of total
		Comunal	montation	Collector	Company		
Domestic	373.9	10.1	7.2	0.2	34.0	425.4	44.0
Commercial	160.5			24.7	56.1	241.3	25.0
Industrial	133.8					133.8	13.9
Market	23.4					23.4	2.0
Street Sweeping	8.4					8.4	1.0
Hospital (1)	20.1					20.1	2.0
Chatarra (2)	0.7	0.1	0.2		1.9	2.9	0.3
Despojos (3)	8.8					8.8	1.0
Caliche (4)	1.1	10.1	5.5	22.7	57.0	96.4	10.0
Sewerage				4.7		4.7	0.5
Total	730.7	20.3	12.8	52.2	148.9	965.0	100.00
% total	75.7	2.1	1.3	5.4	15.4	100.00	

Table J-41: Present Collected Solid Waste Amount from Panama District (Over All)

(1) include common wastes, (2) Large Bulky Waste, 3) Small Bulky Waste, (4) Construction Waste

Table J-42: Present Collected	Solid Waste	Amount from Pa	nama District (ICI)

unit: Tons/							Fons/day
Туре	DIMAUD	Junta Communal	Institution	Private Collector	Private Company	Total	% of total
Institutional							
Government	(1)	-	-			-	
Hospital	20.1	-	-			20.1	3.9
Commercial							
Commerce	160.5	-	-	24.7	56.1	241.3	46.9
Markets	23.4	-	-	-	-	23.4	4.5
Industrial							
Manufacturing	133.8	-	-	-	-	133.8	26.0
Construction	1.1	10.1	-	22.7	57.0	96.4	18.7
Total	338.9	10.1	5.5	47.4	113.1	515.0	-
% of total	65.8	2.0	1.0	9.2	22.0	-	100.0

(1) Billing by DIMAUD to the government entities is through a set amount per entity.

ICI Market

Currently, DIMAUD serves approximately about 70% of the ICI market. This figure includes government entities which are billed a set amount (around 5% of the total ICI waste).

Several private companies haul their wastes by their own means (22% of the total) Around 50% correspond to waste derived from construction activities (57.0 tons/day). Under this situation, DIMAUD could offer them special services and be able to expand its market to an
additional 10% of the total. This could conduct to establish a program to recover construction materials as it has been established in other countries.

Consequently, DIMAUD will be able to attend 70% of the ICI market based on volume generation and would preserve the current fee of U\$ 14.30 per cubic yard.

Strategy to Establish a new Special Collection Service for ICI Waste

In order to provide this new and needed service, the following activities have been proposed:

1. Updating the ICI clients database

The General Controller of the Republic has a database which consists of a Directory of Companies (year 2002). This directory should be compared with clients' database of DIMAUD in order to have an improved and updated database.

2. Geographical location of ICI clients

The General Controller of the Republic has provided to the Panama Municipality a digitalized copy of the District which is updated until October 2002.

This map has limits of the District, corregimientos and barrios, streets, household structures, institutions, commerce, industries and others, such as, hydrographic data.

With this information, it is possible to identify geographically ICI clients, areas, and collection routes for the new service. Additionally, the map can be used to improve the digitalized systems of other services provided by DIMAUD, such as, ordinary collection, street sweeping and commercial activities.

3. Definition of Solid Waste Volume by Client

To initiate immediately a sampling program of solid waste generation based on volume. Generation categories can be established in accordance to their economic activities and project them to the totality of the District. This information is extremely important and the WACS conducted by the JICA Study Team could be taken as reference.

With this information, collection routes can be established and the cost of the service can be evaluated.

4. Design of Areas and Collection Routes

It is recommended that this service begins in Bethania Corregimiento. By using the digitalized map, location of ICI clients and information related to the waste generation by the clients, the design of the areas of service and collection route can initiate.

DIMAUD should proceed with the acquisition of a defined number of standard containers which are suitable for this type of service; subsequently, they could be distributed to the clients on a rental basis. Bethania experience could lead to suggest adjustments which should be conducted in order to expand this service to the rest of the District.

Operation manuals and proceedings can be elaborated simultaneously.

5. Promoting the new service

DIMAUD will design a marketing program for the new service. This program begins with an important advantage: most of the clients are already being serviced by DIMAUD itself. Consequently, this program is not about accessing a new market and making a breakthrough with the clients; the message would be that a new service is being offered with a better quality.

6. Characteristics which will differentiate the new service.

In order to attain the change and loyalty of the clients, it is required that:

- The quality and organization of the service should be equal to that one provided by an efficient model company.
- An independent structure from the ordinary collection service should be preserved.
- The personnel, vehicles and support equipment should of exclusive used of the special service.
- Specialized training of the operative and administrative personnel should be provided.
- Collection frequency and schedule should be followed strictly.
- Personalized attention should be paid to the client.
- The service should be provided through a contract.

a.2 Waste Collection Efficiency Improvement

The collection Improvement Pilot Project estimated cost reduction in this activity at 21%. On the other hand, the 2001 financial report indicated collection service to comprise 46% of DIMAUD cost. Then, 21% of 46%, or 9.66% of const reduction as a whole can be attained through expansion of the manner employed in the pilot project to other areas.

a.3 Fee Collection Improvement by the Commercial Department

The purpose is to expand the income base by exploiting the potential open to DIMAUD through own collection, or a specialized billing/collection firm. Then, DIMAUD can be more financially independent of the IDAAN collection. The target customers are industrial-commercial, which are fewer in number but the source of large potential income, not fully exploited at present.

As industrial-commercial customers are fewer in number, it will be relatively easier to prepare an updated customer list or database as the essential initial step. Implementation can proceed gradually, as database becomes available.

Preparation of industrial-commercial database is planned for 2003 and 2004, using different sources as census, patent or public utilities customer list. Accordingly, implementation is planned for 2004 and 2005, depending on database completion.

Service users may pay at 8 DIMAUD offices or in banks, if banks can be convinced to provide the collection service despite the small number of customers. If collection agreements can be reached with the Treasury Office of the Municipality and Corregimientos, collection rate undoubtedly will improve.

Goal of collection improvement is set at 15% of DIMAUD income in 2004, and at least 30% of income after 2005.

a.4 Simplifying ICI Tariff

The present tariff structure is composed of 11 residential categories with 8 fixed tariffs; 113 types of economic activities with 26 tariffs; and 8 categories of unit-based tariffs. DIMAUD considers that the tariff rates for residential customers are relatively simple and have been accepted by service users.

However, the classification by economic activity is too complex and difficult to apply. Accordingly, the purpose is to introduce the volume-based tariff structure for ICI. Charges per volume should be estimated on the basis of cost of service. In addition, POS results will be checked to explore the possibility of setting the volume-based tariff at a level that can function as cross-subsidy for the 25,000 hardly-paying DIMAUD customers in marginal areas.

The plan is to define the volume-based tariff structure for ICI in 2002. Then, 2003 will be set aside for public information campaign of the new tariff structure. Implementation is planned for 2004 and 2005, depending on database completion.

The goal of tariff simplification, in combination with ICI database preparation and direct collection by DIMAUD, is to secure 15% of DIMAUD income in 2004, and at least 30% of income after 2005.

b. Accounting

b.1 Introduction of COSEPRE Accounting System

The purpose of introducing the COSEPRE (Costos de Servicios Prestados) designed by CEPIS is two-fold: to facilitate generation of real cost by technical component (collection, transport, final disposal), and to facilitate generation of data needed to calculate quantified performance indicators.

Because the present accounting system of DIMAUD is required as the government accounting, the COSEPRE accounting system might have to be implemented as a parallel accounting. This implies the need for additional computing equipment and other resources.

The plan is to conduct preliminary test in 2002, and if everything goes well, implementation is planned for 2003.

b.2 Introduction of Quantified Performance Indicators

Solid waste disposal services are sometimes provided with limitations, thereby permitting fulfillment of the most urgent activities on a day by day basis, without provisions to ensure service viability over the long run. Under these circumstances, the outcome may be deterioration of the service quality, cost increases, and inability to set aside reserves to meet long-term obligations. Then, management efforts are directed toward crisis management, rather than service management.

Income from service charges of solid waste disposal should ideally be reserved for specifically financing the solid waste disposal services. This concept is a crucial element in improving the autonomy of DIMAUD. Improvements in the operation and in the financial management of solid waste disposal can produce important savings, while maintaining or improving the quality of service. And improved finances may permit DIMAUD to have the institutional autonomy and generate internal reserves needed to sustain operations over the long run.

Management of solid wastes as an integrated whole requires providing the service at a price that users can find reasonable and satisfactory for the service level, while generating enough income to provide the service over the long run. The cost of solid waste disposal services should be reasonable for the society as a whole and for individual users. The quality and coverage of the service can be improved with a combination of lower costs (do more for less) and an increase in income. Quality service at lower costs can be attained by computing quantified indicators, which should be constantly monitored and improved. These performance indicators, in turn, depend on the existence of appropriate operation and financial data, which implies the need for a suitable accounting system.

There is consensus about the need to monitor and improve MSWM with the use of quantified indicators, which summarize operation and financial performance.

The purpose of introducing quantified performance indicators is to set up a tool for permanent monitoring and improvement. The expected end result is cost reduction through improvements in the operation and in the financial management.

The quantified performance indicators will be the responsibility of a "Management Control Office", in close cooperation with the other offices. The "Management Control Office" will receive the input data from different DIMAUD offices, calculate the indicators and promptly distribute the results to the top management and the concerned offices that provided the input data. The types of input data will vary according to the specific task of each office, and can include physical quantities, cost data, billing/collection data, absentee and accident data.

The plan is to conduct preliminary test in 2002, and if everything goes well, implementation is planned for 2003.

Type of Indicator	Quantified Indicator						
	Number of DIMAUD employees/1000 population						
	Number of sweeper/1000 population						
General	Kg waste generated/person/day						
	Population/collection vehicles						
	Number of collection worker/1000 population						
	Km/sweeper/day						
	Sq. meter/sweeper/day						
Operation	Number of bags/sweeper/day						
Operation	Number of bags/km						
	Number of brooms/km						
	Km/hours of wages paid						
	Ton/hour collection						
	Ton/vehicle/day						
Collection	Ton/trip						
Collection	Ton/worker/day						
	Worker/vehicle/day						
	Ton collected/hours of wages paid						
	Vehicles in working condition						
Maintananaa	Fuel efficiency						
Maintenance	Tire efficiency						
	Vehicles availability						
Final Disposal	Ton monthly waste/hours monthly machinery						
Liquidity	Current ratio						
Liquidity	Quick ratio						
Managamant	Cost/income ratio						
Management	Receivables turnover ratio						
Commercial	Billing/collection ratio						
	Cost/km sweeping						
Cost	Cost/ton collected						
	Cost/ton final disposal						
Absentee	Absent days x 100/ workable days						
Source: Indicadores	para el Gerenciamiento del Servicio de Limpieza Publica						

Table J-43: Suggested Quantified Indicators

Source: Indicadores para el Gerenciamiento del Servicio de Limpieza Publica, OPS/CEPIS/PUB/01.72, Lima, 2001

J.2.6 Social System (Environment Education and Community Participation)

The environmental education is an important component in SWM. An inappropriate SWM in densely populated area has serious impacts on health of the inhabitants. Therefore, the public should be informed of the potential risks and diseases caused by direct contact with waste and inappropriate procedures of waste handling.

Another important reason for providing environmental education is to let the community be aware of their individual responsibility regarding health improvement and proper waste management.

An informed citizen is more likely to take initiatives in waste minimization, recycling programs; and change in the consumption patterns and they are more likely to pass their knowledge and experiences to all society and future generations. That is to say, the introduction of the sanitary/environmental education and the public participation would open the way to achieve a final goal of this study: to establish a sound Solid Waste Management.

General objective of social aspect consists to promote within Panama District citizenship an environmental culture so that each resident assumes his/her corresponding responsibility as a solid waste generator.

Specific objectives of social aspects are:

- To educate the waste generators on appropriate solid waste management practices and the negative impact on health and the environment derived from the inadequate management of SW.
- To promote the environmental education program in schools, with an emphasis on adequate SWM along all school levels.
- To promote the solid waste separation at source and the reuse of separated materials.
- To encourage waste minimization by reducing packages and packing at industries.
- To inform permanently the community of projects, proposals, or changes on the cleansing service provided by the Municipality.
- To train and update personnel working for the cleansing service of DIMAUD and private companies linked to the service.
- To encourage community participation in SWM and to promote closer links with DIMAUD.
- To establish an Executing Unit with members of Community Relations, Public Relations and the Office for Immediate Response.

J.3 Phased Implementation Plan

The following table presents recommendable timing when the proposed improvement measures will be carried out.

		Implementation Schedule					
Contents of the master Plan	Urgent	Short	Mid	Long	Remarks		
	2002	03-05	06-10	11-15	1		
Increase the waste collection service coverage							
Improvement/Establishment of Technical System				-			
Improvement Storage and discharge system							
Planning							
Implementation							
Collection System							
Basic Database Establishment and Maintenance							
Planning							
Implementation							
Improvement of Collection Efficiency							
Planning							
Implementation							
Introduction of separate collection							
Planning & preparation							
Implementation							
Transfer transport system							
Planning							
Implementation							
Final Disposal							
Improvement of Current Landfill Operation							
Planning							
Implementation							
Ensuring final disposal capacity by 2015							
Planning							
Implementation							
Waste Minimization and Resource Conservation							
Education Program for Encouraging Waste Minimization	n and Recycling						
Planning							
Implementation							
Material Recovery							
Planning							
Implementation							
Improvement of Implementation System	1			•			
Improvement of DIMAUD's Management							
Establishment of Management Indicators							
Planning							
Implementation							
Establishment of Management Information System							
Planning			1	1			
Implementation							
Human Resource Development					1		
Planning			1	1	1		
Improvement of tariff system					-		
Planning				1	1		
			1	1	1		

Table J-44: Phased Im	plementation
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Contents of the master Plan	Urgent	Short	Mid	Long	Remarks
	2002	03-05	06-10	11-15	
Implementation					
Cooperation with Corregimientos					
Planning					
Implementation					
Efficient Use of the Private Sector					
Planning					
Implementation					
Improvement of legal and institutional system					
Municipal Regulations on SWM					
Planning					
Implementation					
Establishment of Committee regarding MSWM					
Planning					
Implementation					
Establishment of Policy on Waste Minimization and Resou	rce Conservat	tion			
Planning					
Implementation					

J.4 Project Cost Estimation

J.4.1 Basic Conditions

This Section presents key design data, unit costs and other basic condition for project cost estimates.

The price and foreign exchange rates are based on them in May 2002.

a. Exchange Rates

US\$ 1.00 = 1.00 Balboa = JP¥125

b. Service Life

Collection Vehicle	:	5 years
Equipment other than collection vehicle		: 7 years
Transfer station and MRF*	:	20 years

* Integrated service life of the facilities including buildings, machines and so on necessary. c. Unit Cost

Table J-45 : Unit Costs

Description	Unit	Unit cost (U\$)
Personnel		
manager	man/year	21,000
engineer	man/year	15,600
supervisor	man/year	5,280
mechanic	man/year	4,956
mechanic assistant	man/year	4,560
driver	man/year	5,400
worker	man/year	4,320
secretary	man/year	5,040
sweeper	man/year	3,420
Earthwork		
machine excavation, 200m transport and stockpiling	m³	3
machine excavation, 500m transport and stockpiling	m³	4
machine excavation, 1,000m transport and stockpiling	m³	5
construction of embankment, machine filling and compaction	m ³	8
synthetic liner (HDPE)	m²	10
clay liner (60 cm)	m²	2
Installation of liner	m²	2
Drainage		

Description	Unit	Unit cost (U\$)
s/t/p 100mm PVC-drainage pipe (earthwork is not included)	m	4
s/t/p 200mm PVC-drainage pipe (earthwork is not included)	m	14
s/t/p 300mm PVC-drainage pipe (earthwork is not included)	m	30
s/t/p 300mm concrete pipe (earthwork is not included)	m	13
s/t/p 450mm concrete pipe (earthwork is not included)	m	29
s/t/p 525mm concrete pipe (earthwork is not included)	m	33
Building	3	
s/t/p premixed concrete 180kg/cm ²	m³	88
s/t/p premixed concrete 210kg/cm ²	m ³	93
s/t/p premixed concrete 280kg/cm ²	m ³	97
Office building R/C including all works	m²	500
Plat form (transfer station)	m ²	350
Workshop, steel structure	m ²	300
Roof (slate covered)	m ²	14
Wall (block)	m ²	14
Road work		
s/t/p concrete road pavement (t=0.15m)	m ²	14
s/t/p hot-mix asphalt road pavement (t=0.1m)	m ²	12
s/t/p gravel road (t=0.3m) and subgrade preparation	m ²	8
Miscellaneous		
weighbridge, 60 ton, with computerized data log system	set	71,000
s/t/p plant trees 2 to 5m in height	tree	7
s/t/p fence (H=2.5m)	m	30
s/t/p gabion, 1.0m x 1.0m x 2m	m ³	16
s/t/p gas removal pipe, 200mm perforated HDPE	m	27
Basic materials		
diesel oil	gallon	1.5
gasoline	gallon	2.0
crushed rock	m ³	10
sand	m ³	14
reinforced bar	ton	305
Equipment (brand-new)		
Refuse collection compactor truck 25yd ³	unit	88,000
Refuse collection compactor truck 16yd ³	unit	77,000
Refuse collection compactor truck 11yd ³	unit	67,000
Dump truck (6ton)	unit	49,000
Dump truck (10ton)	unit	72,000
Tractor-trailer 20t (inc 85yd3 trailer)	unit	124,000
Tractor (pay load 20t), 300-350 hp	unit	77,000
85 yd [°] trailer (hydraulic ejector blade)	unit	47,000
Container truck	unit	90,000
30 yd [°] container for collection vehicle	unit	4,000
Water-tank truck (15,000liter)	unit	108,000

Description	Unit	Unit cost (U\$)
Water-tank truck (10,000liter)	unit	67,000
Road sweeper	unit	138,000
Wheel loader (100kw)	unit	135,000
Wheel loader (70kw)	unit	105,000
Bulldozer (D6 class)	unit	180,000
Bulldozer (D7 class)	unit	250,000
Landfill compactor (CAT 826 class)	unit	240,000
Fork lift (40kw)	unit	28,000
Excavator (100kw)	unit	125,000
Excavator (75kw)	unit	105,000
Container (4.5m ³)	unit	700
Handcart	unit	40

J.4.2 Collection System

The cost of collection system is calculated based on; 1) the life of the collection vehicles is 5 years, 2) all the vehicles purchased before 1997 will be renewed in 2002, and 3) the introduction of separate collection requires additional vehicles. The cost includes purchase, operation and maintenance.

The following two tables show transition of the number of vehicles which will have been purchased by 2015 under the condition of mixed collection and the condition of separate collection executed from 2007 following the M/P.

	Doguirod	Eviating	Total	Scrap	Scrap and replace of existing vehicle Additionally required vehicle		Scrap and replace of existing vehicle		т	otal		
Year	number	vehicle	existing vehicle	Scrap	Replace	Number of working vehicle	New purchase	Scrap	Replace	Number of working vehicle	Number of Purchase	Number of working vehicle
1994		5	5									
1995		1	6									
1996		3	9									
1997		3	12									
1998		15	27									
1999		26	53									
2000		2	55									
2001		1	56									
2002	65			12	12	56	9			9	21	65
2003	67			15	15	56	11			11	26	67
2004	70			26	26	56	14			14	40	70
2005	72			2	2	56	16			16	18	72
2006	76			1	1	56	20			20	21	76
2007	78			12	12	56	22	9	9	22	34	78
2008	80			15	15	56	24	11	11	24	39	80
2009	82			26	26	56	26	14	14	26	52	82
2010	85			2	2	56	29	16	16	29	31	85
2011	87			1	1	56	31	20	20	31	32	87
2012	89			12	12	56	33	22	22	33	45	89
2013	92			15	15	56	36	24	24	36	51	92
2014	94			26	26	56	38	26	26	38	64	94
2015	97			2	2	56	41	29	29	41	43	97
Total				167	167		350	171	171	350	517	

Table J-46 : Collection Vehicle Purchase Plan for Mixed Collection

	Description	F uisting	Total	Scrap and replace of existing vehicle Additionally required vehicle			hicle	Total				
Year	number	vehicle	existing vehicle	Scrap	Replace	Number of working vehicle	New purchase	Scrap	Replace	Number of working vehicle	Number of Purchase	Number of working vehicle
1994		5	5									
1995		1	6									
1996		3	9									
1997		3	12									
1998		15	27									
1999		26	53									
2000		2	55									
2001		1	56									
2002	65			12	12	56	9			9	21	65
2003	67			15	15	56	11			11	26	67
2004	70			26	26	56	14			14	40	70
2005	72			2	2	56	16			16	18	72
2006	76			1	1	56	20			20	21	76
2007	79			12	12	56	23	9	9	23	35	79
2008	82			15	15	56	26	11	11	26	41	82
2009	85			26	26	56	29	14	14	29	55	85
2010	87			2	2	56	31	16	16	31	33	87
2011	91			1	1	56	35	20	20	35	36	91
2012	93			12	12	56	37	23	23	37	49	93
2013	96			15	15	56	40	26	26	40	55	96
2014	100			26	26	56	44	29	29	44	70	100
2015	103			2	2	56	47	31	31	47	49	103
Total				167	167		382	179	179	382	549	

Table J-47 : Collection Vehicle Purchase Plan for Separate Collection

Finally the cost of collection system is estimated using the calculation results shown above under the following conditions.

Table J-48 : Condition o	of Cost Estimation
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	Item	Cost
А	16 yd ³ compactor collection vehicle	U\$ 77,000 /nos.
В	Miscellaneous	10 % of "A"
С	Тах	5 % of "A + B"
D	Total cost	A + B + C
Е	Annual maintenance cost	5 % of "D"

														unit : l	J\$1,000
		n	Mixed co	llection				Se	eparate o	collection	I		Difference		
Year	Vehicle	Miscella neous	Tax	Total	Mainte nance cost	Total	Vehicle	Miscell aneous	Tax	Total	Mainte nance cost	Total	Total	Initial	Mainte nance
2007	2,618	262	144	3,024	605	3,629	2,695	270	148	3,113	623	3,736	107	89	18
2008	3,003	300	165	3,468	694	4,162	3,157	316	174	3,647	729	4,376	214	179	35
2009	4,004	400	220	4,624	925	5,549	4,235	424	233	4,892	978	5,870	321	268	53
2010	2,387	239	131	2,757	551	3,308	2,541	254	140	2,935	587	3,522	214	178	36
2011	2,464	246	136	2,846	569	3,415	2,772	277	152	3,201	640	3,841	426	355	71
2012	3,465	347	191	4,003	800	4,803	3,773	377	208	4,358	872	5,230	427	355	72
2013	3,927	393	216	4,536	907	5,443	4,235	424	233	4,892	978	5,870	427	356	71
2014	4,928	493	271	5,692	1,138	6,830	5,390	539	296	6,225	1,245	7,470	640	533	107
2015	3,311	331	182	3,824	765	4,589	3,773	377	208	4,358	872	5,230	641	534	107
Total	30,107	3,011	1,656	34,774	6,954	41,728	32,571	3,258	1,792	37,621	7,524	45,145	3,417	2,847	570

Table J-49 : Results of Cost Estimation

J.4.3 **Transfer and Transport System**

Table J-50 shows overall costs necessary for the transfer and transport system for the East (Tocumen, Pacora and San Martin). Detailed costs are presented in the section of Feasibility Study.

Table J-50: Overall Cost of Transfer	/ Transport System for the East
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														unit :	: U\$1,000
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2,015	Total
Transfer station															
Investment															
Land acquisition			346												346
Design & supervision		67	67			55									189
Capital cost			2,693			1,821									4,514
Investment total	0	67	3,106	0	0	1,876	0	0	0	0	0	0	0	0	5,049
O & M				211	211	211	270	270	270	270	270	270	270	270	2,793
Sub total	0	67	3,106	211	211	2,087	270	270	270	270	270	270	270	270	7,842
Transport															
Tractor (300-350hp)				356	89	89	89	0	0	89	356	178	89	178	1,513
O&M (w/o personnel)				66	82	99	115	115	115	132	132	148	148	165	1,317
Personnel				56	70	84	98	98	98	112	112	126	126	140	1,120
Trailer (85 yd3, 20 ton)				326	54	54	163	0	0	54	326	109	54	217	1,357
O&M (w/o personnel)				7	8	9	12	12	12	13	13	14	14	16	130
Sub total				811	303	335	477	225	225	400	939	575	431	716	5,437
Total	0	67	3,106	1,022	514	2,422	747	495	495	670	1,209	845	701	986	13,279

J.4.4 Material Recovery Facility

a. Outline of Facility

Outline of the MRF is shown below.

Item	Descriptions							
	Year	Capacity	Total Capacity					
	2007	25 ton/day	25 ton/day					
Installation plan	2009	40 ton/day	65 ton/day					
installation plan	2011	60 ton/day	125 ton/day					
	2013	185 ton/day						
	2015	222 ton/day						
Daily working time	7.0 hour/day							
Sorting item	paper, steel, aluminum, plastic, bottle and glass							
Sorting method	magnetic separation and hand picking							
Site area	Approximate 10,000 m ²							
Building area	Approximate 6,000 m ²							

Table J-51 : Outline of Facility

b. Cost Estimation

Result of cost estimation is shown below.

Vear	Canacity	Cost (U\$ 1,000)								
i cai	Capacity	Construction	Equipment	Total	Tax	Total				
2006	25 (ton/day)	150	600	750	38	788				
2008	40 (ton/day)	240	960	1,200	60	1,260				
2010	60 (ton/day)	360	1,440	1,800	90	1,890				
2012	60 (ton/day)	360	1,440	1,800	90	1,890				
2014 37 (ton/day)		162	648	810	41	851				
Total		1,272	5,088	6,360	319	6,679				
Land acquisit	ion cost	assuming MR	RF install in Cerro	Patacon		0				

J.4.5 Landfill

a. Improvement of Current Landfill

Cost for improvement of current landfill shows below.

Table J-53: Unit Cost of Leachate Collection System per Hectare

Item	Description	Unit	Quantity	Unit cost (U\$)	Cost (U\$)
Main	dia 300mm	m	560	60.0	33,600
Branch	dia 200mm	m	560	20.0	11,200
Total					44,800

Table J-54: Unit cost of Final Cover and Rain Water Channel

Item	Description	Unit	Quantity	Unit cost (U\$)	Cost (U\$)
Vegetation layer	600mm	m²	10,500	3.0	31,500
Sand layer	300 mm	m³	3,150	5.0	15,750
Synthetic liner	HDPE 1.5mm	m²	10,500	12.0	126,000
Clay liner	600 mm	m²	10,500	3.0	31,500
Gavel layer	150 mm	m²	10,500	2.0	21,000
Rain water drainage		m²	10,500	0.3	3,150
Total					228,900

Table J-55: Total Unit Cost

Item	Description	Unit	Quantity	Unit cost (U\$)	Cost (U\$)
Total unit cost of Leachate collection and cover soil		U\$/ha			273,700

Table J-56: Total Project Cost for Chatarra

Item	Description	Unit	Quantity	Unit cost (U\$)	Cost (U\$)
Chatarra		ha	5.0	273,700	1,368,500
Contingency		%	10.0		136,850
	Direct cost				1,505,350
Overhead		%	30.0		451,605
	Constriction cost				1,956,955
Тах		%	5.0		97,848
Total					2,054,803

Item	Description	Unit	Quantity	Unit cost (U\$)	Cost (U\$)
Etapa I		ha	14.5	273,700	3,968,650
Contingency		%	10.0		396,865
	Direct cost				4,365,515
Overhead		%	30.0		1,309,655
	Construction cost				5,675,170
Тах		%	5.0		283,759
Total					5,958,929

Table J-57: Total Project Cost for Etapa I

Table J-58: Overall Cost

Item	Cost (U\$)
Chatarra	2,054,803
Etapa I	5,958,929
Total	8,013,732

Table J-59: Approximate Cost of Leachate Treatment Improvement

Description	Unit	Quantity	Unit cost (U\$)	Cost (U\$)
Leachate treatment facility (Case4)	m³/day	1,200	3,000	3,600,000

Table J-60 shows overall costs of the current landfill improvement.

														Unit:	0\$1,000
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Investment															
Closure of Etap 1	0	6,000	0	0	0	0	0	0	0	0	0	0	0	0	6,000
Closure chatarra	0	1,000	1,000	0	0	0	0	0	0	0	0	0	0	0	2,000
Etpa 2 phase 4*1	0	3,500	0	0	0	0	0	0	0	0	0	0	0	0	3,500
Improvement leachate treatment	0	0	1,800	1,800	0	0	0	0	0	0	0	0	0	0	3,600
Investment total	0	10,500	2,800	1,800	0	0	0	0	0	0	0	0	0	0	15,100
O & M															
Closure of Etap 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Closure chatarra	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Etap 2 /phsae 3,4,5*1	0	2,742	2,848	2,966	1,531	0	0	0	0	0	0	0	0	0	10,087
Improvement leachate treatment * ²	0	0	0	180	180	180	180	180	180	180	180	180	180	180	1,980
O&M total	0	2,742	2,848	3,146	1,711	180	180	180	180	180	180	180	180	180	12,067
Investment	0	10,500	2,800	1,800	0	0	0	0	0	0	0	0	0	0	15,100
O & M	0	2,742	2,848	3,146	1,711	180	180	180	180	180	180	180	180	180	12,067
Total	0	13,242	5,648	4,946	1,711	180	180	180	180	180	180	180	180	180	27,167

Table J-60: Overall Cost of Current Landfill Improvement

*1: information obtained from DIMAUD

*2: 5% of the investment cost

b. New Landfill

Table J-61 shows overall costs of the new landfill (Etapa 3). Detailed costs are presented in the section of Feasibility Study.

														unit	:U\$ 1,000
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Landfill site															
Investment															
Design & supervision			66	66	306	306	341	341	8	8					1,442
Construction				4,400		20,400		22,700		500					48,000
Investment total			66	4,466	306	20,706	341	23,041	8	508					49,422
O&M				2,811	2,811	2,811	2,811	2,811	2,811	2,811	3,469	3,469	3,469	3,469	33,553
Total	0	0	66	7,277	3,117	23,517	3,152	25,852	2,819	3,319	3,469	3,469	3,469	3,469	82,995
Leachate treatr	nent														
Investment															
Design & supervision			75	75											150
Construction				5,000											5,000
Investment total			75	5,075											5,150
O&M				135	135	135	135	135	135	135	135	135	135	135	1,485
Total	0	0	75	5,210	135	135	135	135	135	135	135	135	135	135	6,635
Total															
Investment total	0	0	141	9,541	306	20,706	341	23,041	8	508	0	0	0	0	54,592
O & M total	0	0	0	2,946	2,946	2,946	2,946	2,946	2,946	2,946	3,604	3,604	3,604	3,604	35,038
Total	0	0	141	12,487	3,252	23,652	3,287	25,987	2,954	3,454	3,604	3,604	3,604	3,604	89,630

Table J-61: Overall Cost of Landfill (Etapa 3)

J.4.6 Overall Cost

a. Implementation plan

Project implementation plan is shown below. The overall cost will be calculated based on this implementation plan.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Collection system														
Separate collection		Prepa	ration						Oper	ation				
I ranster system			r	r			1			r		r		
Tocumen			Const.					O	peratio	n				
MRF (Cerro Patacor	ו)													
25 ton/day					Const.				C	peratio	n			
40 ton/day							Const.			C	peratio	n		
60 ton/day									Const.		C	peratio	n	
60 ton/day											Const.	C	peratio	n
37 ton/day													Const.	Ope.
Landfill (Cerro Pata	con)													
Etapa 2		Exist	ing site											
Etapa 3 (new land	dfill site)						•	•					
Phase 1				Cons	it. O	peration	1							
Phase 2						Co	onst.	Operatio	on					
Phase 3								Со	nst. Op	eration				
Phase 4										Const.		Oper	ation	

Table J-62 : Implementation plan

b. Overall cost

Overall costs, which include implementation of the separate collection and installation of facilities proposed in the M/P, are shown below.

										. ,				unit	: U\$1,000
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2,015	Total
Separate Collection															
Investment															
Purchase collection vehicle	0	0	0	0	0	89	179	268	178	355	355	356	533	534	2,847
Investment total	0	0	0	0	0	89	179	268	178	355	355	356	533	534	2,847
O&M	0	0	0	0	0	206	418	625	418	831	831	831	1,242	1,249	6,651
Total	0	0	0	0	0	295	597	893	596	1,186	1,186	1,187	1,775	1,783	9,498
Transfer system															
Investment															
Land acquisition			346												346
Design & supervision		67	67			55									189
Capital			2,693			1,821									4,514
Total	0	67	3,106	0	0	1,876	0	0	0	0	0	0	0	0	5,049
O & M				211	211	211	270	270	270	270	270	270	270	270	2,793
Total	0	67	3,106	211	211	2,087	270	270	270	270	270	270	270	270	7,842
Transport															
Tractor (300-350hp)				356	89	89	89	0	0	89	356	178	89	178	1,513
Trailer (85 yd3, 20 ton)				326	54	54	163	0	0	54	326	109	54	217	1,357
Investment total	0	0	0	682	143	143	252	0	0	143	682	287	143	395	2,870
O&M (w/o personnel)				66	82	99	115	115	115	132	132	148	148	165	1,317
Personnel				56	70	84	98	98	98	112	112	126	126	140	1,120
O&M (w/o personnel)				7	8	9	12	12	12	13	13	14	14	16	130
O&M total	0	0	0	129	160	192	225	225	225	257	257	288	288	321	2,567
Total	0	0	0	811	303	335	477	225	225	400	939	575	431	716	5,437
total	0	67	3,106	1,022	514	2,422	747	495	495	670	1,209	845	701	986	13,279
MRF (Cerro Patacon)															
Investment															
Land acquisition					0										0
Design & supervision				20	20	32	32	47	47	47	47	21	21		334
Construction					150		252		378		378		171		1,329
Equipment					630		1,008		1,512		1,512		681		5,343
Total	0	0	0	20	800	32	1,292	47	1,937	47	1,937	21	873	0	7,006
O & M						40	40	105	105	202	204	301	301	345	1,643
Total	0	0	0	20	800	72	1,332	152	2,042	249	2,141	322	1,174	345	8,649

Table J-64: Overall Cost (2)

														unit	: U\$1,000
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2,015	Total
Landfill (Cerro Pata	icon)														
Landfill site															
Investment															
Design & supervision			66	66	306	306	341	341	8	8					1,442
Construction				4,400		20,400		22,700		500					48,000
O&M				2,811	2,811	2,811	2,811	2,811	2,811	2,811	3,469	3,469	3,469	3,469	33,553
Total	0	0	66	7,277	3,117	23,517	3,152	25,852	2,819	3,319	3,469	3,469	3,469	3,469	82,995
Leachate treatment															
Investment															
Design & supervision			75	75											150
Construction				5,000											5,000
O&M				135	135	135	135	135	135	135	135	135	135	135	1,485
Total	0	0	75	5,210	135	135	135	135	135	135	135	135	135	135	6,635
Investment total	0	0	141	9,541	306	20,706	341	23,041	8	508	0	0	0	0	54,592
O & M total	0	0	0	2,946	2,946	2,946	2,946	2,946	2,946	2,946	3,604	3,604	3,604	3,604	35,038
Total	0	0	141	12,487	3,252	23,652	3,287	25,987	2,954	3,454	3,604	3,604	3,604	3,604	89,630

Table J-65: Overall Cost (3)

														unit	: U\$1,000
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Overall costs															
Investment															
Separate Collection	0	0	0	0	0	89	179	268	178	355	355	356	533	534	2,847
Transfer station	0	67	3,106	0	0	1,876	0	0	0	0	0	0	0	0	5,049
Tractor (300-350hp)	0	0	0	356	89	89	89	0	0	89	356	178	89	178	1,513
Trailer (85 yd3, 20 ton)	0	0	0	326	54	54	163	0	0	54	326	109	54	217	1,357
MRF (Cerro Patacon)	0	0	0	20	800	32	1,292	47	1,937	47	1,937	21	873	0	7,006
Landfill (Cerro Patacon)	0	0	141	9,541	306	20,706	341	23,041	8	508	0	0	0	0	54,592
Total	0	67	3,247	10,243	1,249	22,846	2,064	23,356	2,123	1,053	2,974	664	1,549	929	72,364
Operation and mainten	ance														
Separate Collection	0	0	0	0	0	206	418	625	418	831	831	831	1,242	1,249	6,651
Transfer station	0	0	0	211	211	211	270	270	270	270	270	270	270	270	2,793
Tractor (300-350hp)	0	0	0	122	152	183	213	213	213	244	244	274	274	305	2,437
Trailer (85 yd3, 20 ton)	0	0	0	7	8	9	12	12	12	13	13	14	14	16	130
MRF (Cerro Patacon)	0	0	0	0	0	40	40	105	105	202	204	301	301	345	1,643
Landfill (Cerro Patacon)	0	0	0	2,946	2,946	2,946	2,946	2,946	2,946	2,946	3,604	3,604	3,604	3,604	35,038
Total	0	0	0	3,286	3,317	3,595	3,899	4,171	3,964	4,506	5,166	5,294	5,705	5,789	48,692
Investment and O&M	total														
Total	0	67	3,247	13,529	4,566	26,441	5,963	27,527	6,087	5,559	8,140	5,958	7,254	6,718	121,056

Total Overall Cost

Total overall costs, which include implementation of the separate collection, installation of facilities and improvement current landfill system proposed in the M/P, are shown below.

														Unit	. Uş 1,000
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Investment															
New item	0	67	3,247	10,243	1,249	22,846	2,064	23,356	2,123	1,053	2,974	664	1,549	929	72,364
Current landfill	0	10,500	2,800	1,800	0	0	0	0	0	0	0	0	0	0	15,100
Investment total	0	10,567	6,047	12,043	1,249	22,846	2,064	23,356	2,123	1,053	2,974	664	1,549	929	87,464
O&M															
New item	0	0	0	3,286	3,317	3,595	3,899	4,171	3,964	4,506	5,166	5,294	5,705	5,789	48,692
Current landfill	0	2 742	2 848	3 146	1 711	180	180	180	180	180	180	180	180	180	12 067
O&M total	0	2,742	2,848	6,432	5,028	3,775	4,079	4,351	4,144	4,686	5,346	5,474	5,885	5,969	60,759
Total	0	13,309	8,895	18,475	6,277	26,621	6,143	27,707	6,267	5,739	8,320	6,138	7,434	6,898	148,223

Table J-66: Total Overall Cost

c. Incremental Cost

The separate collection and the MRF are new projects. The required costs presented so far are incremental to the costs of the existing system.

However, there exists the final disposal system that requires a certain amount of costs at present. Therefore it is necessary to clarify incremental costs incurred by the new landfill project to analyze its validity from financial and economic aspects that will be carried out later. This incremental cost can be obtained by subtracting the cost required for the existing system (base cost) from the cost required for the new project.

Meanwhile, it is expected that the transfer and transport system will bring cost reduction in collection works. Therefore, incremental costs have to count such cost reduction.

This section presents incremental costs incurred by implementation of the Master Plan with taking into account the aforementioned.

c.1 Base Cost

Table J-67 shows cost per ton of waste according to respective activities in 2001 based on the financial report of DIMAUD and the final disposal amount at the Cerro Patacon Landfill. The cost required for the existing landfill (base cost) is US\$ 6/ton.

2001 d	isposal amount	433,027.62ton/year	
Item	2001 cost (U\$/year)	Unit cost for disposal amount (U\$/ton)	Share
Administrative	3,935,387.98	9.088	18.1%
Collection	10,090,778.29	23.303	46.4%
Maintenance	1,488,635.78	3.438	6.8%
Landfill	2,612,096.64	6.032	12.0%
Sweeping	3,047,337.99	7.037	14.0%
Landscaping	580,310.37	1.340	2.7%
Total	21,754,547.05	50.238	100.0%

Table J-67: MSW Unit Cost in 2001

c.2 Effect of Transfer and Transport System

Table J-68 presents cost reduction by introduction of the transfer and transport system.

Table J-68: Cost Effect of Transfer and Transport System

unit : U\$ 1,000

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	total
Without T&S system	0	0	0	2,687	1,962	2,649	2,300	3,838	3,000	3,672	3,127	4,735	3,896	4,596	36,462
With T&S system	0	67	3,106	2,604	2,126	3,699	1,989	1,792	2,970	2,898	2,960	2,705	2,527	4,079	33,522
Cost effect	0	67	3,106	-83	164	1,050	-311	-2,046	-30	-774	-167	-2,030	-1,369	-517	-2,940

Introduction of the Transfer and Transport System will bring cost reduction of U\$2,940,000 by year 2015. The system will operate from 2005. Between 2005 and 2015 the system will deal with about 1,390,000 ton of waste. That is, U\$2.116 per ton of waste is reduced. Based on these figures, Table J-69 presents the cost reduction of each year.

Table J-69: T/S handling Amount ar	nd Saving Cost
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	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
T/S handling amount (ton/year)	0	0	0	87,710	95,265	102,419	109,281	116,618	124,283	132,459	141,182	150,234	159,907	170,090	1,389,448
													Unit cost	(U\$/ton)	-2.116
Saving cost (U\$1,000)	0	0	0	-185	-202	-217	-231	-247	-263	-280	-299	-318	-338	-360	-2,940

c.3 Total Incremental Cost

Table J-70 shows the total incremental cost incurred by implementation of the Master Plan. Table J-71 presents incremental cost per ton of disposal waste. Both costs per total disposal amount and per disposal amount originating from only Panama District are shown as the Cerro Patacon Landfill receives waste originating from other than Panama District.

														unit	: U\$1,000
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Total cost	0	13,309	8,895	18,475	6,277	26,621	6,143	27,707	6,267	5,739	8,320	6,138	7,434	6,898	148,223
Landfill base cost	0	-2,742	-2,848	-2,966	-1,531	-3,216	-3,306	-3,404	-3,493	-3,588	-3,684	-3,788	-3,895	-4,009	-42,470
Incremental cost (1)	0	10,567	6,047	15,509	4,746	23,405	2,837	24,303	2,774	2,151	4,636	2,350	3,539	2,889	105,753
Collection cost for T/S effect	0	0	0	-185	-202	-217	-231	-247	-263	-280	-299	-318	-338	-360	-2,940
Incremental cost (2)	0	10,567	6,047	15,324	4,544	23,188	2,606	24,056	2,511	1,871	4,337	2,032	3,201	2,529	102,813

Table J-70: Incremental Cost

|--|

														u	nit : U\$/ton
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
For whole disposal amount	0.00	23.12	12.74	31.37	9.17	43.67	5.15	42.83	4.77	3.60	7.55	3.72	5.45	4.32	13.59
For disposal amount from Panama	0.00	29.10	16.10	39.89	11.74	56.40	6.70	56.20	6.31	4.81	10.20	5.08	7.51	6.02	17.89

d. Concession

The cost presented so far is for a case where DIAMUD would procure funds, construct and operate the facilities. It was found in the case that large deficits would happen in a cash flow when investments concentrate. Therefore, this section considers carrying out some components of the M/P under concession contract in order to overcome the deficits. Three cases of concession are analyzed as shown in Table J-72.

	Landfill	Transfer system	MRF
Case 0	DIMAUD direct	DIMAUD direct	DIMAUD direct
Case 1	Concession	DIMAUD direct	DIMAUD direct
Case 2	Concession	Concession	DIMAUD direct
Case 3	Concession	Concession	Concession

Table J-72:	Examine	Case for	Concession

d.1 Fund-raise Conditions

The required costs for the facilities construction presented so far include financial charges such as for borrowing money for a short term. However, financial charges that would be required to the private sector for financing for a long term is not included. Although conditionality for financing is depending on banking establishments, typical conditionality for international financing affaires set by Japan Bank for International Cooperation (JBIC) is applied for the consideration herewith. The conditionality is shown in Table J-73.

Table J-73: Interest of JBIC Investment Credit

			Yen loan	Foreign currency loan	Loan amount
Annual	interest	Normal	1.4 %	LIBOR + 0.4375%	60 to 70%
rate		Special	0.75 to 1.10%	LIBOR to LIBOR+0.25%	001070%

LIBOR : 6 month rate of US\$ London International Bank Offer Rate

Meanwhile, LIBOR (London International Bank for Offer Rate) for 6 month financing in November 2002 was 1.43%. With this 1.43% and the table above, 1.68 to 1.8675% is obtained. Taking into account the interest rates of JBIC and LIBOR, the consideration will use 1.8% and borrowed money is set as 70% of necessary expenses. Table J-74 summarize the conditionality employed in the consideration.

Annual interest rate	1.8 %
Own fund	30 %
Borrowed	70 %

Table J-74: Loan Conditions

d.2 Borrowing and Repayment Plan

With the conditionality, repayment by a contractor to a bank and payment by DIMAUD to the contractor are presented in the following tables for each project, the Final Disposal System, Transfer and Transport System and Material Recovery Facility.

Table J-75: Borrowing Condition for Landfill

Total cost (U\$ 1,000)	116,797
Own fund (U\$ 1,000)	35,039
Borrowed (U\$ 1,000)	81,758
Annual interest	1.8%

Table J-76: Repayment Plan of Concessionaire for Landfill

													Unit : U	\$1,000
	Total	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Compound value	92,427	7,110	7,110	7,110	7,110	7,110	7,110	7,110	7,110	7,110	7,110	7,110	7,110	7,110
Capital	81,758	5,638	5,740	5,843	5,948	6,055	6,164	6,275	6,388	6,503	6,620	6,739	6,861	6,984
Interest charge	10,669	1,472	1,370	1,267	1,162	1,055	946	835	722	607	490	371	249	126
Outstanding amount	81,758	76,120	70,380	64,537	58,589	52,534	46,370	40,095	33,707	27,204	20,584	13,845	6,984	0
Total required fund	127,466													

Table J-77: DIMAUD Repayment Plan for Landfill

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Landfill amount (ton/year)	456,980	474,719	494,320	517,424	535,966	551,004	567,393	582,102	597,943	613,930	631,414	649,189	668,096	7,340,480
DIMAUD payment (U\$ 1,000/year)	7,935	8,243	8,584	8,985	9,307	9,568	9,853	10,108	10,383	10,661	10,965	11,273	11,601	127,466

Table J-78: Borrowing Condition for Transfer System

Total cost (U\$ 1,000)	13,279
Own fund (U\$ 1,000)	3,984
Borrowed (U\$ 1,000)	9,295
Annual interest	1.8%

												Unit : U	\$1,000
	Total	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Compound value	10,418	868	868	868	868	868	868	868	868	868	868	868	867
Capital	9,295	701	713	726	739	753	766	780	794	808	823	838	852
Interest charge	1,123	167	155	142	129	115	102	88	74	60	45	30	15
Outstanding amount	9,295	8,594	7,881	7,155	6,416	5,663	4,897	4,117	3,323	2,515	1,692	852	0
Total required fund	14,402												

Table J-79: Repayment Plan of Concessionaire for Transfer System

Table J-80: DIMAUD Repayment Plan for Transfer System

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Landfill amount (ton/year)	87,710	95,265	102,419	109,281	116,618	124,283	132,459	141,182	150,234	159,907	170,090	1,389,448
DIMAUD payment (U\$ 1,000/year)	909	987	1,062	1,133	1,209	1,288	1,373	1,463	1,557	1,657	1,763	14,401

Table J-81: Borrowing Condition for MRF

Total cost (U\$ 1,000)	8,649
Own fund (U\$ 1,000)	2,595
Borrowed (U\$ 1,000)	6,054
Annual interest	1.8%

Table J-82: Repayment Plan of Concessionaire for MRF

										Unit :	U\$1,000
	Total	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Compound value	6,669	667	667	667	667	667	667	667	667	667	666
Capital	6,054	558	568	578	589	599	610	621	632	644	654
Interest charge	615	109	99	89	78	68	57	46	35	23	12
Outstanding amount	6,054	5,496	4,928	4,350	3,761	3,162	2,552	1,931	1,299	653	0
Total required fund	9,264										

Table J-83: DIMAUD Repayment Plan for MRF

		2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Landfill (ton/year)	amount	4,271	8,760	13,505	23,178	33,398	44,129	55,517	67,525	81,030	331,313
DIMAUD (U\$ 1,000/y	payment year)	119	245	378	648	934	1,234	1,552	1,888	2,266	9,264

d.3 Overall Cost

Required funds to DIMAUD for each case are summarized in the following tables.

Table J-84: Case 1	(Concession f	for Landfill)
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													Unit: U	\$ 1,000
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Existing cost	20,218	21,001	21,868	24,463	23,802	24,564	25,394	26,249	27,163	28,105	29,121	30,166	31,282	333,396
DIMUD direct operation	67	3,106	1,042	1,314	2,789	2,676	1,540	3,133	2,105	4,536	2,354	3,650	3,114	31,426
Concession	7,935	8,243	8,584	8,985	9,307	9,568	9,853	10,108	10,383	10,661	10,965	11,273	11,601	127,466
New investment total	8,002	11,349	9,626	10,299	12,096	12,244	11,393	13,241	12,488	15,197	13,319	14,923	14,715	158,892
Total	28,220	32,350	31,494	34,762	35,898	36,808	36,787	39,490	39,651	43,302	42,440	45,089	45,997	492,288

Table J-85: Case 2 (Concession for Landfill and Transfer System)

													Unit: U	\$ 1,000
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Existing cost	20,218	21,001	21,868	24,463	23,802	24,564	25,394	26,249	27,163	28,105	29,121	30,166	31,282	333,396
DIMUD direct operation	0	0	20	800	367	1,929	1,045	2,638	1,435	3,327	1,509	2,949	2,128	18,147
Concession	7,935	8,243	9,493	9,972	10,369	10,701	11,062	11,396	11,756	12,124	12,522	12,930	13,364	141,867
New investment total	7,935	8,243	9,513	10,772	10,736	12,630	12,107	14,034	13,191	15,451	14,031	15,879	15,492	160,014
Total	28,153	29,244	31,381	35,235	34,538	37,194	37,501	40,283	40,354	43,556	43,152	46,045	46,774	493,410

Table J-86: Case 3 (Concession for Landfill, Transfer System and MRF)

													Unit: U	\$ 1,000
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Existing cost	20,218	21,001	21,868	24,463	23,802	24,564	25,394	26,249	27,163	28,105	29,121	30,166	31,282	333,396
DIMUD direct operation	0	0	0	0	295	597	893	596	1,186	1,186	1,187	1,775	1,783	9,498
Concession	7,935	8,243	9,493	9,972	10,488	10,946	11,440	12,044	12,690	13,358	14,074	14,818	15,630	151,131
New investment total	7,935	8,243	9,493	9,972	10,783	11,543	12,333	12,640	13,876	14,544	15,261	16,593	17,413	160,629
Total	28,153	29,244	31,361	34,435	34,585	36,107	37,727	38,889	41,039	42,649	44,382	46,759	48,695	494,025

Table J-87: Overall Cost

														Unit: L	J\$ 1,000
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	Unit cost (U\$/lan dfill ton)
Case 0 (DIMAUD Direct operation)	33,527	29,896	40,343	30,740	50,423	30,707	53,101	32,516	32,902	36,425	35,259	37,600	38,180	481,619	65.611
Case 1	28,220	32,350	31,494	34,762	35,898	36,808	36,787	39,490	39,651	43,302	42,440	45,089	45,997	492,288	67.065
Case 2	28,153	29,244	31,381	35,235	34,538	37,194	37,501	40,283	40,354	43,556	43,152	46,045	46,774	493,410	67.218
Case 3	28,153	29,244	31,361	34,435	34,585	36,107	37,727	38,889	41,039	42,649	44,382	46,759	48,695	494,025	67.301

J.5 Evaluation of Master Plan

J.5.1 Technical Evaluation

Practicability of the components proposed in the M/P will be evaluated from a view point of technical level of the present Panama municipality.

The major components proposed in the M/P are;

- Introduction of Separate Collection
- Introduction of Transfer and Transport System
- Installation of Material Recovery Facility (MRF)
- Expansion of landfill

a. Separate Collection

The separate collection proposed in the M/P was initiated in this study as a pilot project. After five years of a preparation period, from 2002 to 2006, full-scale implementation will start in 2007 aiming at about 50% separate collection rate in 2015, the target year of the M/P.

Collection system generally needs to be modified for introduction of separate collection. The M/P suggests no introduction of new technology but to change frequency and timing of collection. Therefore, from a technical point of view, the introduction of separate collection is considered practicable.

b. Transfer Transport System

Currently, waste transport is conducted regardless of the distance from the Final Disposal Site by collection vehicles. The M/P proposes installation of a transfer station at the East of Panama District, which covers Tocumen, Pacora and San Martin. To improve the transport efficiency, 85yd³ trailers will be installed.

85yd³ trailers will be the first case in the waste management in Panama District. However, such trailers and tractors are often used in the private sector for transporting merchandises and others. Therefore, operation and maintenance will not encounter serious problems in a technical viewpoint.

Type of transfer station proposed in the M/P is direct dump station, which does not employ complicated machines such as compactors. Then, it is easy to operate and maintain. Therefore, it can be said that this type of transfer station is appropriate for the first-time introduction.

c. Material Recovery Facility (MRF)

The first MRF is planed to start operation from 2007. Since the facility will be a simple structure with combination of conveyers and magnetic separators, technologically the facility could be installed immediately without serious problems. However, success of MRF depends on soft components rather that hard ones such as facility construction and O&M. The soft components are, for instance, the way to improve impurity rate of collected materials which are transported to the MRF and how to provide the recovered materials to the market and so on. To practice and assure these soft components, the M/P proposes a period of about five years before the operation of the facility.

Judging from this long preparation period and the technical level of Panama municipality, the introduction of this facility is considered practicable.

d. Expansion of landfill

The present landfill of Cerro Patacon has liner system and leachate treatment facilities. All these facilities were planned, designed and implemented by the Panama municipality. Therefore, it is considered that the Panama municipality has enough knowledge and experience for expansion of the landfill and other related constructions.

Meanwhile, there were problems in landfill management such as lack of cover soil and landfilling methods etc. Some of problems have been improved through the Landfill Operation Improvement Pilot Project that has left variable data and experiences to operate the sanitary landfill properly.

Consequently, it can be said that the final disposal system will be improved with the plans and designs provided by the M/P and based on the experiences obtained through the pilot project.

J.5.2 Financial Evaluation

This section describes results of the following financial considerations regarding the M/P.

- 1. Financial situation of DIMAUD without the M/P
- 2. Financial situation of DIMAUD with the M/P
- 3. Implementation options: for finding an option that achieves sound financial condition of DIMAUD
- 4. Burden of solid waste services on household income: for checking Ability to Pay of households for solid waste services
- 5. Financial viability: for confirming financial viability of the M/P with Financial Internal Rate of Return (FIRR) and sensitivity analysis.

a. Without Master Plan

Under "Without Master Plan" or "Do Nothing" case, cash flow was estimated on the basis of projections of 2001 and 2002 situations. Highly sensitive to variations in income and expenses, cash flow is estimated to become negative anytime within the planning period 2003-2015, probably around 2007. Sufficient attention should be paid to the fact that once the DIMAUD financial balance becomes negative, the situation gets worse every year, that is, the shortage of income over expenses widens year by year.

Year	Total Income (\$million)	Total Cost (\$million)	Cash Flow (\$million)
2003	24.4	23.0	1.4
2004	24.6	23.8	0.8
2005	25.3	24.8	0.5
2006	26.1	26.0	0.1
2007	27.0	27.0	-0.07
2008	27.7	27.9	-0.14
2009	28.6	28.8	-0.23
2010	29.4	29.7	-0.30
2011	30.4	30.8	-0.39
2012	31.3	31.8	-0.44
2013	32.4	32.9	-0.53
2014	33.5	34.1	-0.59
2015	34.6	35.3	-0.65
Total	375.4	375.9	-0.46

Table J-88: Financial Situation without Master Plan

b. With Master Plan

The case "With Master Plan" incorporated the findings made during the Study.

b.1 Cost

i) Existing Cost

Cost of the existing system was projected on the basis of the 2001 and 2002 situations.

ii) Incremental Cost

Incremental Cost needed to implement the Master Plan was estimated at around \$105.8 million during the implementation period 2003-2015.

b.2 Income

Income was estimated by source.

i) Households

Income from households was estimated using the following data.

Population and family size

Population projection was made by the Study Team, and the family size of 4.4 resulted from the Public Opinion Survey.

Income Groups and Willingness to Pay (WTP)

The Public Opinion Survey determined low income households to comprise 43.0% of the population, middle income 46.6% and high income 10.4%. The revealed monthly WTP was \$4.16 for low income, \$7.09 for middle income, and \$9.43 for high income. Accordingly, the corresponding tariff used in the income estimation from households was \$5.00 for low income, \$7.20 for middle income, and \$10.30 for high income. Adjustments were made for coverage of solid waste service and collection/billing ratio.

ii) Commerce, Industry

Income from Commerce, Industry was estimated on the basis of data from waste amount and composition survey (WACS), and waste stream analysis, by applying the existing volume-based tariff of \$14.3 per cubic yard.

Commerce: 115.6 ton/day, density 60 kg/cubic meter

Industry: 159.6 ton/day, density 150 kg/cubic meter

Restaurant: 106.4 ton/day, density 200 kg/cubic meter

Assumption was that 70% of this group of clients would be served by DIMAUD, making adjustments for billing/collection ratio. Further, it was assumed that the special collection service charging the volume-based tariff would be implemented 70% in 2003, 90% in 2004 and 100% in 2005. Thereafter, the growth of income from this client group would be according to the growth rate of the economy.

iii) Institution

The 2002 situation was projected with \$50,000 to \$60,000 monthly increase already included in the 2003 budget of the Central Government, as a result of lobbying efforts made by the DIMAUD Commercial Department.

iv) Sanitary Landfill

Projection of the 2002 situation was used. The income potential of San Miguelito Municipality (over one million dollars a year) was left aside, due to the likelihood of a lengthy legal battle, if actions were taken to require San Miguelito Municipality to pay their share of final disposal fees.

v) Government Subsidy

Income from this source was estimated at the 2001 and 2002 level.

vi) Other Income

Projection of 2002 situation was used.

vii) Additional Income

Additional income was estimated as transport cost reduction resulting from the introduction of the transfer station, and the cost reduction resulting from improvement in the collection service.

b.3 Implementation Options

Several Financial Options for implementing the M/P are analyzed herewith. Those options are the following.

- Directly by DIMAUD without borrowed funds
- Directly by DIMAUD with borrowed funds,

- Concession (Landfill)
- Concession (Landfill and Transfer & Transport)
- Concession (Landfill, Transfer & Transport and Material Recovery Facility)

i) Directly by DIMAUD without borrowed funds

As a pre-requisite, DIMAUD will have to implement the increase in income from commercial firms using the volume-based tariff, and the cost reduction resulting from improvement in the collection service. In addition, DIMAUD will have to find a way to cover the large cash flow deficits of \$3.9 million in 2003, \$3.1 million in 2005, \$10.6 million in 2007 and \$10.9 million in 2009.

Year	Total Income (\$million)	Total Cost (\$million)	Cash Flow (\$million)
2003	29.7	33.5	-3.9
2004	33.8	29.9	3.9
2005	37.3	40.3	-3.1
2006	38.4	30.7	7.7
2007	39.8	50.4	-10.6
2008	41.0	30.7	10.3
2009	42.1	53.1	-10.9
2010	43.4	32.5	10.9
2011	44.7	32.9	11.8
2012	46.0	36.4	9.6
2013	47.4	35.3	12.2
2014	48.9	37.6	11.3
2015	50.5	38.2	12.3
Total	543.1	481.6	61.5

Table J-89: DIMAUD Direct Implementation of M/P without Borrowed Funds

ii) Directly by DIMAUD with borrowed funds

To overcome the large cash flow deficits in some years, an international soft loan can be considered for financing the Master Plan under DIMAUD direct operation. Financing the Master Plan with borrowed funds requires careful considerations of financing terms and conditions. On November 18, 2002, LIBOR was 1.43%, which adding some risk factors can go to 1.8%. Soft loans for very specific purposes could be found possibly at 1.8% interest rate, repayment over 25 years with 7 years grace period.

The required costs planned in the Master Plan amount to \$105.8 million between 2003 and 2015. Assuming 70% is financed with borrowed funds, DIMAUD needs to borrow about \$74.0 million between 2003 and 2015, but in addition should prepare around \$31.8 million of own funds as counterpart funds for the Master Plan implementation. Assuming an interest
rate of 1.8% and repayment over 25 years with 7 years grace period, repayment amount is estimated at \$96.6 Million, as summarized below.

Item	Implementation	Repayment
Interest Rate	1.8%	1.8%
Repayment Period		25 years of disbursement: 2010-2039
Grace Period		7 years: 2003-2009
Implementation	13 years: 2003-2015	
Required Costs	\$105.8 million	
Borrowed Funds	\$74.0 million	\$96.6 million
Own Funds	\$31.8 million	

	Table J-90:	Financing	M/P with	Borrowed	Funds
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International soft loans will have to be processed through diplomatic channels, and the required bureaucratic procedure will make it impossible to start implementation in 2003.

iii) Concession

Concession option was considered separately for each component activity and its corresponding cost (Sanitary Landfill, Transfer & Transport, and Materials Recovery Facility). "Separate Collection" was excluded from concession, as this activity will have to be always under direct DIMAUD operation. Cost specification by activity permitted analysis of concession of only one or more activities.

Concession of Sanitary Landfill

By operating only Sanitary Landfill under concession, cash flow would be positive in every year, and the resulting financial balance over the planning period would amount to \$31.6 million. It is worth noting that the concession of the sanitary landfill eliminates as income source the final disposal fee that was charged to the difference between total waste disposed and the waste collected/ disposed by DIMAUD. Therefore, total income is less under concession than under direct DIMAUD operation.

Voar	Income		Cash Flow		
Teal	(\$million)	DIMAUD	Concession	Total	(\$million)
2003	28.5	20.3	7.9	28.2	0.27
2004	32.6	24.1	8.2	32.4	0.26
2005	36.0	22.9	8.6	31.5	4.5
2006	37.1	25.8	9.0	34.8	2.3
2007	38.5	26.6	9.3	36.0	2.5
2008	39.5	27.2	9.6	36.8	2.7
2009	40.7	26.9	9.9	36.8	3.9
2010	41.9	29.4	10.1	39.5	2.4
2011	43.1	29.3	10.4	39.7	3.5
2012	44.4	32.6	10.7	43.3	1.1
2013	45.8	31.5	11.0	42.4	3.3
2014	47.2	33.8	11.3	45.1	2.1
2015	48.7	34.4	11.6	46.0	2.7
Total	523.9	364.8	127.5	492.3	31.6

Concession of Sanitary Landfill and Transfer and Transport

Concession of Sanitary Landfill (SL) and Transfer & Transport (TT) is estimated to result in positive cash flow in every year of the implementation period, and the resulting financial balance over the planning period would amount to \$30.5 million.

Table J-92: Ma	ster Plan	under Concession of Sanitary Landfill and T Transport	ransfer &

Vear	Income		Cost (\$million)				
l cai	(\$million)	DIMAUD	Concession	Total	(\$million)		
2003	28.5	20.2	7.9	28.2	0.3		
2004	32.6	21.0	8.2	29.2	3.4		
2005	36.0	21.9	9.5	31.4	4.6		
2006	37.1	25.3	10.0	35.2	1.9		
2007	38.5	24.2	10.4	34.5	3.9		
2008	39.5	26.5	10.7	37.2	2.4		
2009	40.7	26.4	11.1	37.5	3.2		
2010	41.9	28.9	11.4	40.3	1.6		
2011	43.1	28.6	11.8	40.4	2.8		
2012	44.4	31.4	12.1	43.6	0.9		
2013	45.8	30.6	12.5	43.2	2.6		
2014	47.2	33.1	12.9	46.0	1.1		
2015	48.7	33.4	13.4	46.8	1.9		
Total	523.9	351.5	141.9	493.4	30.5		

Concession of Sanitary Landfill, Transfer & Transport, and MRF

And finally, concession of Sanitary Landfill (SL), Transfer & Transport (TT) and Materials Recovery Facility (MRF) is estimated to result in a small negative cash flow of \$32,000 in 2015, and the resulting financial balance over the planning period would amount to \$29.9 million.

Year			Cash Flow (\$million)		
	(arrinori)	DIMAUD	Concession	Total	
2003	28.5	20.2	7.9	28.2	0.3
2004	32.6	21.0	8.2	29.2	3.4
2005	36.0	21.9	9.5	31.4	4.7
2006	37.1	24.5	10.0	34.4	2.7
2007	38.5	24.1	10.5	34.6	3.9
2008	39.5	25.2	10.9	36.1	3.4
2009	40.7	26.3	11.4	37.7	3.0
2010	41.9	26.9	12.0	38.9	3.0
2011	43.1	28.3	12.7	41.0	2.1
2012	44.4	29.3	13.4	42.6	1.8
2013	45.8	30.3	14.1	44.4	1.4
2014	47.2	31.9	14.8	46.8	0.4
2015	48.7	33.1	15.6	48.7	-0.03
Total	523.9	342.9	151.1	494.0	29.9

Table J-93: Master Plan under Concession of Sanitary Landfill, Transfer & Transpo	ort
and MRF	

All concession options would result in positive cash flow in all but one year of the planning period under the option in which concession is considered for landfill, transfer station and materials recovery facility. It can be seen that the appeal of concession is the possibility of overcoming large negative cash flows that would occur under direct DIMAUD operation.

b.4 Requirements

Implementation of the Master Plan requires income increase and cost reduction.

Income requirements

The most important, and just about the only income increase that can be expected, is that from commercial/industrial firms, which requires the following:

- Passage of the Municipal Ordinance
- Implement special service for commercial/industrial firms

Cost requirements

Cost should be reduced by improving operations according to recommendations resulting from the Collection Improvement Experiment. Another important source of cost reduction would be payroll control by optimizing personnel.

c. Burden of SW Service Fee on Household Income

On the presumption of more than one wage earner per family, the household income was assumed to exceed the officially set minimum monthly wages of \$253.80. Therefore, the household income was estimated by multiplying the minimum salary by a factor of 1.5 for the low income group, 5 for the middle income group, and 12 for the high income group. This process made the household income levels consistent with the income range used in the POS. According to POS results, low income households were assumed to comprise 43.0%, middle income households 46.6% and high income households 10.4%. The combination of all these data and assumptions resulted in average household monthly income of \$1,072 in 2001 and 2002, going up to \$1,136 in 2003 and 2004.

The World Bank estimates the share of solid waste expenses in the household budget to be around 0.7% to 1.7%, which are generally regarded as the range of **Ability to Pay (ATP)** of households for solid waste services.

The burden of the SW service fee on household income was estimated as a ratio between the estimated cost of SW service per household, and the estimated average household income. For the 2002 situation, the following analysis can be made.

Item	Value
Total Estimated Cost in 2002	\$22,167,000
Percentage of waste from Households	51.2%
51.2% of Total Cost allocated to Households	\$11,349,504
Number of Households	169,193
51.2% of SW Cost allocated to Household sector in 2002	\$67.08
Estimated Average Household Yearly Income	\$12,864
Burden of SW Cost on Household Income: 51.2%	0.52%

Table J-94: Burden of Solid Waste Serve Cost on Household Income, 2002

According to the preceding table, the burden of SW cost was estimated as 0.52% of household income in 2002, if 51.2% of the Total Cost of SW service was distributed to households according to the percentage of waste generated by households. During the project period 2003-2015, and considering past increases in minimum wages, the household income was estimated to grow by 6% every two years, coinciding with the review of minimum wages.

The burden on household income was estimated as the ratio between the annual SW service cost per household, as per the 51.2% of waste generation attributed to households in the waste stream analysis, and the annual household income. The result can be summarized as follows.

	With Master Plan Case					
Year	Minimum wages (\$/month)	Household Income (\$/month)	Average SW Cost (\$/month)	Cost/Income (%)		
2003	269	1,136	8.24	0.73		
2004	269	1,136	7.15	0.63		
2005	285	1,204	9.37	0.78		
2006	285	1,204	6.94	0.58		
2007	302	1,277	11.04	0.86		
2008	302	1,277	6.52	0.51		
2009	320	1,353	10.91	0.81		
2010	320	1,353	6.46	0.48		
2011	340	1,434	6.32	0.44		
2012	340	1,434	6.75	0.47		
2013	360	1,520	6.30	0.41		
2014	360	1,520	6.48	0.43		
2015	382	1,612	6.33	0.39		

Table J-95: Burden of Solid Waste Service Cost on Household Income with M/P

The above table shows that the cost of SW service per household is way below the upper limit of 1.7% of average household income. Consequently, it can be judged that the cost of SW service "With Master Plan" is within the Ability to Pay of households.

When the cost of SW service was based on the three cases of concession, the burden on household income was as shown in the following table.

	Base Data		Landfill		Landfill & TT		Landfill,	TT, MRF
Year	Minim. Wages (\$/month)	Hhold. Income (\$/month)	Avg.SW Cost (\$/month)	Cost/Inco me (%)	Avg.SW Cost (\$/month)	Cost/Inco me (%)	Avg.SW Cost (\$/month)	Cost/Inco me (%)
2003	269	1,136	6.93	0.61	6.92	0.61	6.92	0.61
2004	269	1,136	7.73	0.68	6.99	0.62	6.99	0.62
2005	285	1,204	7.32	0.61	7.29	0.61	7.29	0.61
2006	285	1,204	7.84	0.65	7.95	0.66	7.77	0.65
2007	302	1,277	7.86	0.62	7.56	0.59	7.57	0.59
2008	302	1,277	7.81	0.61	7.90	0.62	7.66	0.60
2009	320	1,353	7.56	0.56	7.71	0.57	7.75	0.57
2010	320	1,353	7.85	0.58	8.01	0.59	7.73	0.57
2011	340	1,434	7.61	0.53	7.75	0.54	7.88	0.55
2012	340	1,434	8.03	0.56	8.07	0.56	7.91	0.55
2013	360	1,520	7.59	0.50	7.72	0.51	7.94	0.52
2014	360	1,520	7.77	0.51	7.93	0.52	8.05	0.53
2015	382	1,612	7.62	0.47	7.75	0.48	8.07	0.50

Table J-96: Burden of Solid Waste Service Cost on Household Income with M/P under Concession

TT: Transfer & Transport

MRF: Materials Recovery Facility

The above table shows that the burden of SW service cost on household income is even lower under concession, thereby confirming that the service is affordable for the residents of Panama District. However, as there are income differentials among Corregimientos in the Panama District, the SW service affordability was checked for the households in Curundu and found to be affordable, as shown in the table below.

Year	Master Plan		Concession	
		LF	LF,TT	LF,TT,MRF
2003	1.39	1.17	1.05	1.17
2004	1.21	1.31	1.07	1.18
2005	1.50	1.17	1.05	1.16
2006	1.11	1.25	1.15	1.27
2007	1.66	1.18	1.02	1.14
2008	0.98	1.17	1.07	1.19
2009	1.55	1.07	0.99	1.09
2010	0.92	1.11	1.03	1.14
2011	0.85	1.02	0.94	1.04
2012	0.90	1.07	0.98	1.08
2013	0.80	0.96	0.88	0.97
2014	0.82	0.98	0.91	1.00
2015	0.75	0.91	0.84	0.92

Table J-97: Burden of Solid Waste Service Cost on Curundu Household Income (%)

d. Financial Evaluation

Financial evaluation consisted of calculating the financial internal rate of return, and then conducting sensitivity analysis.

d.1 Financial Internal Rate of Return (FIRR)

Implementation of the Master Plan between 2003 and 2015 would give a positive financial balance of \$61.5 million for the period, resulting in a financial internal rate of return (FIRR) of 47.5%. The high FIRR should be viewed with caution because it is extremely sensitive to variations in income. If government subsidy is eliminated as income source, the FIRR would go down to 17.8%. And if government subsidy plus income from landfill are eliminated, FIRR would go down to 7.4%.

Posing still greater problems, large cash flow deficits are expected in some years: around \$3.9 million in 2003, \$3.1 million in 2005, \$10.6 million in 2007 and \$10.9 million in 2009.

d.2 Sensitivity Analysis

Sensitivity analysis was conducted by assuming a 10% reduction in total income, a 10% increase in total cost, and a simultaneous 5% reduction in total income and 5% increase in total cost. Results are summarized in the following table.

Cases	FIRR
Base Case	47.5%
Income reduction: -10%	3.4%
Cost Increase: +10%	5.8%
Income reduction: -5% and Cost Increase: +5%	4.6%

Table J-98: Sensitivity Analysis

d.3 Conclusions

- The Master Plan can give attractive financial returns, but it is quite sensitive to variations in income and cost.
- It is more sensitive to variations in income: a 10% reduction in total income causes FIRR to go down from 47.5% to 3.4%
- A 10% increase in cost causes FIRR to go down from 47.5% to 5.8%.
- A simultaneous 5% income reduction and 5% cost increase cause FIRR to go down from 47.5% to 4.6%.

• The viability of the Master Plan hinges on achieving income increase and cost reduction. Income increase implies implementation of the volume-based tariff applicable to commercial/industrial firms, while cost reduction depends heavily on improving collection efficiency.

J.5.3 Economic Evaluation

The investment plan proposed in the M/P is practicable for DIMAUD and is expected to mitigate aggravation of urban sanitation and improve urban environment and social welfare through the effective MSWM.

Quantitative economic evaluation of the M/P is conducted by calculating Economic Internal Rate of Return (EIRR) and Benefit-Cost Ratio with the following benefit and cost.

- Willingness to Pay of U\$6.07/household/month, which obtained through the Public Opinion Survey (POS), is regarded as benefit of the M/P.
- Amount, which is obtained by deducting 5% of tax from the existing and new costs required for the M/P, is assumed as cost.

a. Willingness to Pay

The results of POS say that i) Willingness to Pay is U\$6.07/household/month and ii) average number of family members is 4.4 persons/house. Meanwhile, the Waste Amount and Composition Survey (WACS) obtains the waste generation amount as 590g/person/day. From these data, Willingness to Pay and waste generation amount per person per year can be obtained as U\$16.56 and 0.215 ton respectively as shown in the following.

 $U\$6.07 / household / month \div 4.4 person / household = U\$1.38 / person / month$ $U\$1.38 / person / month \times 12month = U\$16.56 / yera / person$ $590g / person / day \times 365 days = 0.215 ton / year / person$ Consequently, Willingness to Pay per ton of waste is obtained as U\$77.02/ton as follows.

U\$16.56/ year / person \div 0.215ton / year / person = U\$77.02 / ton

b. Economic Evaluation

b.1 Method

The Willingness to Pay obtained by POS corresponds to benefit that is regarded to be brought about by the whole MSWM, not only by new projects/measures proposed in the M/P, as each component of MSWM achieves the benefit in total combination. Therefore, this economic evaluation subjects to the whole MSWM.

b.2 Cost

Investment costs for new projects proposed in the M/P is subtracted 5% of tax. Costs of O&M for the new projects and the existing activities are used as they are.

b.3 Benefit

As the whole MSMW of the Panama District is subject to this economic evaluation, it is regarded that economic benefit would be delivered to all beneficiaries of DIMAUD service, or all citizens and business entities in Panama District. Therefore, the value obtained by multiplying the Willingness to Pay per ton of waste by the whole waste amount generated from the Panama District is considered as the economic benefit.

b.4 Economic Evaluation

Implementation of the M/P will bring about the following cost reductions.

- Cost reduction in the collection and transport works with introduction of the Transfer and Transport System
- Cost reduction in the collection works: the collection improvement pilot project proved that 21% of cost reduction in the collection works would be achievable, which is equivalent to 9.66% of the whole MSWM costs of DIMAUD in year 2001.

In this economic evaluation, three cases where the above cost reductions are considered or not considered (See Table J-99) are analyzed as presented in the following.

	Cost	Benefit
Case 1	Existing cost + incremental cost	
Case 2	(Existing cost + incremental cost) – (saving cost by T/S system)	vvillingness to
Case 3	(Existing cost + incremental cost) – (save cost by T/S system + cost reduction of collection system)	(U\$ 77.02/ton)

Table J-100: Cost and Benefit

		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
	Investment	10,567	6,047	12,043	1,249	22,846	2,064	23,356	2,123	1,053	2,974	664	1,549	929	87,464
	O & M	2,742	2,848	6,432	5,028	3,775	4,079	4,351	4,144	4,686	5,346	5,474	5,885	5,969	60,759
	Total	13,309	8,895	18,475	6,277	26,621	6,143	27,707	6,267	5,739	8,320	6,138	7,434	6,898	148,223
	Existing cost	20,218	21,001	21,868	24,463	23,802	24,564	25,394	26,249	27,163	28,105	29,121	30,166	31,282	333,396
(00	Investment (exc. tax 5%)	10,064	5,759	11,470	1,190	21,758	1,966	22,244	2,022	1,003	2,832	632	1,475	885	83,300
1,0	O & M	2,742	2,848	6,432	5,028	3,775	4,079	4,351	4,144	4,686	5,346	5,474	5,885	5,969	60,759
\$N)	Total (Case 1)	33,024	29,608	39,770	30,681	49,335	30,609	51,989	32,415	32,852	36,283	35,227	37,526	38,136	477,455
ost															
O	Saving cost (T/S)	0	0	-185	-202	-217	-231	-247	-263	-280	-299	-318	-338	-360	-2,940
	Total (Case 2)	33,024	29,608	39,585	30,479	49,118	30,378	51,742	32,152	32,572	35,984	34,909	37,188	37,776	474,515
	Reduction cost (collection)	-2,373	-2,454	-2,540	-2,642	-2,711	-2,766	-2,825	-2,871	-2,922	-2,971	-3,024	-3,077	-3,133	-36,309
	Total (Case 3)	30,651	27,154	37,045	27,837	46,407	27,612	48,917	29,281	29,650	33,013	31,885	34,111	34,643	438,206
Benefit	Waste amount - Panama ((ton/year)	363,175	375,549	388,835	404,384	416,794	427,050	438,256	449,388	461,360	473,551	486,582	499,758	514,030	
	Willingness to pay (U\$1,000)	27,972	28,925	29,948	31,146	32,101	32,891	33,754	34,612	35,534	36,473	37,477	38,491	39,591	438,915

Table J-101: EIRR and B/C

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	EIRR	B/C
Case 1	-5,052	-683	-9,822	465	-17,234	2,282	-18,235	2,197	2,682	190	2,250	965	1,455	-26.32%	0.919
Case 2	-5,052	-683	-9,637	667	-17,017	2,513	-17,988	2,460	2,962	489	2,568	1,303	1,815	-23.18%	0.925
Case 3	-2,679	1,771	-7,097	3,309	-14,306	5,279	-15,163	5,331	5,884	3,460	5,592	4,380	4,948	0.47%	1.002

As the results show, the benefit-cost rate slightly exceeds 1.0 and EIRR barely becomes positive in the Case 3 where the Transfer and Transport System is introduced and the collection improvement is carried out as proposed in the M/P.

Consequently, it is evaluated that the M/P is economically feasible and upgrades the urban environment as well as improve the efficiency of MSWM carried out by DIMAUD.

J.5.4 Institutional Evaluation

The proposed institutional system of the M/P is oriented to form the "Development of the Institutional Capacity" of DIMAUD.

The objectives and activities in the following five sectors that compose the system interact among themselves to achieve the most synergy possible and attain the goals proposed in the M/P.

a. Sector of Policies and Regulations

It is expected that the Panama Municipal Council will approve the Cleansing Regulation (Municipal Ordinance). This regulation would establish a policy related to solid waste management in the District and the regulation to provide this type of service.

DIMAUD is compelled to provide the service with levels that are defined in the regulation. Additionally, the clients and general public are to collaborate and participate actively. In few words, the "rules of the game" have been defined.

The private sector would be able to develop its activities through a competition based on quality and price set by the regulation. This situation will certainly benefit the ICI waste dischargers who are possible clients to the private sector's service.

b. Adjustment of the Organization Structure

The top management of DIMAUD has decided to initiate the adjustment of the organizational structure with the purpose to adapt it to the requirements of the objectives of the entity.

The adjustment would facilitate to attain the synergy among all administrative units including the existing ones and those which are being proposed.

The organization gains efficiency by establishing new administrative units. These units will execute current and new activities: for example, the Department of Operations (optimization of operations); the Executive Unit (planning and development); Management Control (management improvement and control); Customer Service (relations with the clients).

c. Development of Human Resources

It is usually said that human resources are the most valuable asset in any entity. For each administrative unit, programs and activities have been proposed directed to train the personnel and improve their skills.

Social and human aspects are considered with great concern. There are plans to negotiate with the Caja del Seguro Social (CSS) the situation of workers who are close or past the

retirement age and others who have disabilities and provide their service in street sweeping as a manner of anticipated retirement in order for them to receive pensions.

The control and reduction of labor accidents and professional diseases, such as back problem, can be achieved by strengthening the occupational program of the CSS.

All these activities are positive; they generate greater trust and devotion on the workers, and also create a loyalty with the entity.

d. Management Development

The establishment of a system management control will serve as a guide to take decisions. An understanding of the performance levels and their comparison with standards from other countries with similar development degree will derive on the improvement of the efficiency on the services that are being provided.

The top management of the entity should have management information tools of great value to orient and arrange all the activities. The operative personnel could use them to control the daily operations and suggest improvements which can lead to provide a service with better quality and with less cost.

e. Financial Development

The financial analysis shows a reasonable equilibrium between the investment foreseen in the M/P and expenditures for operation and management, and the projected income. In order to attain these results, it is required a great discipline to manage the funds, an improvement the efficiency of the ordinary collection service, implementation of the special collection service for ICI's, to modernize the commercialization system and an skilful negotiation of the concession process of the sanitary landfill.

The M/P provides a series of procedures and tools to materialize the financial equilibrium aforementioned.

J.5.5 Social Evaluation

Aiming at environmental conservation, the M/P includes separate collection. It desperately requires cooperation from the citizens. Therefore, the environmental education will be an inevitable factor to encourage citizens for proper understanding of SWM and environment.

The M/P emphasizes the environmental education as a social component, which is expected to realize resource conservation and efficient MSWM.

During the Study, pilot projects verify that material recovery proposed in the M/P is viable. It is judged that separate collection at source and community based material recovery will be workable with proper provision of environmental education in Panama District.

Meanwhile, there is another important social issue in MSWM, i.e., waste-pickers. As one of tools to solve this problem, the Municipal Ordinance stipulates that the material extraction in the flow of discharged wastes is prohibited and the Panama Municipality will carry out the required formalities. Such required formalities would be control and job opportunity creation. Fence around Etapa 2 will be constructed at the beginning of 2003, then entrance and exit of the waste-pickers will be controlled at one gate. The MRF proposed in the M/P would be a job opportunity.

Consequently, it is evaluated that the M/P will contribute to solution of social problems.

J.5.6 Environmental Evaluation

From an environmental point of view, the M/P is evaluated at the following respects.

- Resource conservation and minimization of final disposal amount through separate collection
- Promotion of recycling through introduction of MRF
- Environmental improvement through appropriate installation and operation of the final disposal site

The introduction of separate collection and installation of MRF contribute to environmental improvement. Recyclable materials that used to be disposed as wastes are recovered and "re-cycled" as resources, which leads to conservation of natural resources and minimization of final disposal amount.

Installation of the final disposal site with appropriate specification and its proper operation in accordance with the M/P will mitigate environmental impact around the final disposal site.

J.5.7 Overall Evaluation

The validity of the M/P was evaluated from technical, financial, economical, institutional, social and environmental viewpoints.

The proposed technical system will be effective to achieve the M/P's goal, or Establishment of Sound Solid Waste Management in the Panama District, through i) Elimination of waste from the living environment, in order to preserve citizens' health, ii) Establishment of appropriate final disposal system, and iii) Encouragement of waste minimization. The collection improvement and the establishment of the transfer and transport system will ensure the elimination of waste from the living environment. Improvement of the existing landfill operation and the new landfill development will guarantee the establishment of appropriate final disposal system. And, the separate collection, MRF and the environmental education will make sure the waste minimization. Technologies proposed here have well taken into account the degree of technical level and acceptability of the Panama District.

However, it is true that the proposed technical system will require higher technical capabilities and management abilities. In order to cope with this matter, technology transfer was carried out during the Study through various activities such as implementation of pilot projects and joint formulation of the M/P. Besides, the Municipal Ordinance prepared during the study will be a firm foundation where service providers (DIMAUD and the private sector), clients (citizens and business entities) and supervisors (MINSA and Municipality) can participate positively and act properly in the MSWM. Responsibilities and tasks set for each department and units of DIMAUD will orient them to the M/P's goal.

Financial analysis found that the implementation of the M/P would cause large deficits in cash flow of DIMAUD in some years, although the financial situation would be positive in total. Then, it was clarified that concession contract of major components, such as Landfill, Transfer and Transport and MRF, to the private sector could overcome such large deficits. Such concession means effective use of assets of the private sector to the public. Furthermore, economic analysis clarified that the M/P will bring about benefits to the whole citizens of Panama District.

As the M/P is a kind of environment improvement projects, it will of course contribute to improvement of environmental quality of the Panama District. The environment education proposed in the M/P will take for a certain time to harvest its fruits. However, it is clear that it will bring about waste minimization and citizens' consciousness-raising on MSWM, then, it will ensure sustainability of provision of a Sound MSWM in the Panama District.

Consequently, it is evaluated that the M/P's goal will bring benefit for the citizens of the Panama District, besides for the global environment from a viewpoint of resource

conservation, and the proposed measures in the M/P are effective, efficient and sustainable to achieve the goal.

Annex K

Feasibility Study and Pre-Feasibility Study for Priority Projects Contents

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K Feasibility Study and Pre-feasibility Study for Priority Projects

K.1 Outline of the Projects

K.1.1 Target

It is indispensable to secure a final disposal site for a sound Solid Waste Management. There is a plan to expand the existing landfill, or Etapa 2 in the Cerro Patacon Landfill. The part to be expanded is called Phase 4 of Etapa 2 and will have a capacity of 1,800,000 m³. The Phase 4 will be full by the beginning of 2006. Then, another new landfill will be necessary. Therefore, a feasibility study is conducted under the scheme of the Study for a new landfill, or Cerro Patacon Etapa 3, to be operated between 2006 and 2015.

Waste collection works require a large amount of costs. At present, about 46% of the total SWM costs are spent for the collection works. Therefore, it is expected that improvement of collection efficiency will bring a considerably large cost reduction and will help the SWM stable. The collection works can be divided into two components, i.e., collection that picks up waste from generation sources in an area and transport that carries waste collected to a final disposal site.

In the Study, a pilot project to improve the collection efficiency was carried out. It brought a result of 21% reduction of the direct cost in the pilot project area. Meanwhile, it has also been sought to improve efficiency of transport in the eastern area (Tocumen, Pacora and San Martin) and northern area (Chilibre) where the distances to the Cerro Patacon Landfill exceed 40 km (a round trip). Therefore, aiming at improve the efficiency of the transport, a pre-feasibility study of transfer and transport systems in the areas were carried out

K.1.2 Outline of Projects

Table K-1 shows the outline of the final disposal project. Table K-2 presents the transfer transport project.

Itomo	Facilities									
items	Overall	Phase 1	Phase 2	Phase 3	Phase 4					
Construction site	Cerro Patacon Area									
Construction period	-	2005 to early 2006	2007 to early 2008	2009 to early 2010	2011					
Operation period	2006 to 2015	early 2006 to early 2008	early 2008 to early 2010	early 2010 to end of 2011	2012 to 2015					
Area	Site area :28 ha Filling area : 20.4 ha	6.9 ha	6.5 ha	6.3 ha	20.4 ha					
Landfill waste		Munici	pal waste							
Landfill capacity	6,400,000 m ³	1,300,000m ³	1,200,000m ³	1,100,000m ³	2,800,000m ³					
Access	Existing road and internal road Length of internal road : 2,570 m	Length of internal road : 1,300 m	Length of internal road : 800m	Length of internal road : 470m	-					
Waste transport control facilities	Gate : 2 (existing), Weighbridge : 2 (existing), Car washing : 1 (existing), Site office :1, Work shop :1									
	Seepage control works: installation of 1.5 mm HDPE synthetic liner with 10 mm geotextile (under and upper of synthetic liner), installation of soil layer for protection of synthetic liner									
	Collection and treatment system									
Leachate	Collection pipe: 6,690m(dia. 200 to 900mm)	2,070 m	2,020m	1,830m	770m					
management	Treatment system Regulation pond : 24,000 m ³ ,Treatment capacity : 800 m ³ /day (oxidation ditch with chemical sedimentation, sand filtration and activated carbon absorption) Intake water quality : BOD 10,000 mg/l, COD 18,000 mg/l, Org-N 200 mg/l, NH ₃ -N 200 mg/l, P 30mg/l Treated water quality ; BOD 35 mg/l, COD 100 mg/l, Org-N 10 mg/l, NH ₃ -N 3 mg/l, P 5mg/l (comply the ANAM discharge limit)									
Landfill gas management	Gas ventilation pipe (PVC 200 mm) : 92 nos.	23 nos.	22 nos.	21 nos.	26 nos.					
Rain water management	Trapezoidal lined ditch (wide 800 to 1,700 mm): 2,300 m and daily cover soil	1,190 m	700 m	410 m	-					
Landfill operation	Cell method with compaction, daily soil cover thickness15cm, final soil cover thickness 60cm									
Aesthetic design	Daily soil cover									
Closure and post-closure	Final soil cover 60 cm Greening by seeding the final cover with grass									

Table K-1: Outline of the Final Disposal Project (Feasibility Study)

Table K-2: Outline of the Transfer and Transport Project (Pre-feasibility Study)

Items	Facilities		
	Overall	Phase 1	Phase 2
Construction site	Possibly along the American Highway in Pacora Corregimiento (the site will be looked for later by DIMAUD)		
Construction period	-	2004	2007
Operation period	From 2005 (economic life of the transfer station is assumed as 20 years)	From 2005	From 2008
Site area	5 ha	-	-
Target Waste	Municipal waste generated from Tocumen, Pacora and San Martin corregimientos		
Facilities	Direct dump station		
Platform	2,500 m ²	1,250 m ²	1,250 m ²
Hopper	4 units	2 units	2 units
Weighbridge	2 units	1 unit	1 unit
Others	Office, workshop, fence, gate, car washer, buffer zone		
Transport Equipment	Tractor-trailer (20 ton); 17 units of tractor and 25 units of trailer are to be purchased in total between 2005 and 2015.		
Collection Vehicle	16 yd ³ (12.2m ³) compactor truck; 67 units are to be purchased in total between 2005 and 2015.		